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No. 385



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30 November 1976

# USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

## GEOPHYSICS, ASTRONOMY AND SPACE

No. 385

This serial publication contains abstracts of articles from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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## I. ASTRONOMY

### News

#### TV-COMPUTER COMPLEX FOR ASTRONOMICAL OBSERVATIONS

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.249

[Abstract of article by S. V. Zasorin and V. K. Zlobin; Ryazan', SPETSIAL-IZIR. I KOMBINIR. VYCHISL. USTROYSTVA, No 2, 1975, pp 37-44, "Television-Computer Complex for Automating Astronomical Observations"]

[Text] The article examines the theoretical problems related to the creation of automated complexes (consisting of a television receiver of information and an electronic computer) making it possible to carry out automatic identification of star configurations. For identifying stars the authors propose construction of a standard frame -- a mathematical model of the observed sector of the sky, the objects in which are described by rectangular Cartesian coordinates. Expressions are given which relate the equatorial coordinates of the celestial body and the rectangular coordinates of the corresponding point on the standard frame. A method is proposed for organizing a computer catalogue of stars. A block diagram of the complex is given.

[63]

## Abstracts of Scientific Articles

### FIRST GLOBAL RADIOTELESCOPE

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 2, No 10, 1976, pp 467-473

[Article by R. Batchelor, D. L. Jauncey, K. J. Johnston, V. A. Yefanov, L. R. Kogan, V. N. Kostenko, L. I. Matveyenko, I. G. Moiseyev, S. H. Knowles, A. Kh. Papatsenko, R. Preston, J. Spenser, A. N. Timofeyev, N. F. Fourikis and R. W. Schilizzi, "First Global Radiotelescope"]

[Abstract] On 28 April and 6 May 1976 radiotelescopes on three continents were joined together for carrying out observations of maser H<sub>2</sub>O sources with an angular resolution of 0.1 msec of arc. The global radiotelescope was formed by four antennas: the 22-m antenna of the Crimean Astrophysical Observatory at Simeiz, the 26-m antenna of the Naval Research Laboratory at Maryland Point, the 40-m antenna of the radio observatory in Owens Valley, and the 64-m NASA antenna at Tidbinbilla, Australia. The paper cited above gives the first results of these observations for the radiosources W 49N and W 51. It was found that W 51 is a compact source all of whose components fall in the range  $\sim 30$  msec of arc. W 49 N, however, is more complex and has many components falling in a region with dimensions  $\sim 5''$ .

[81]

### POSSIBLE MECHANISM OF SUNSPOT FORMATION

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.449

[Abstract of article by L. I. Gudzenko and V. Ye. Chertoprud; Moscow, KRATKIYE SOOBSHCH. PO FIZ., No 12, 1975, pp 17-21, "Possible Mechanism of Sunspot Formation"]

[Text] A study was made of the adiabatic cooling of a magnetized element (cavern) which floats up and expands at depths near the photosphere. It is assumed that the magnetic field of sectors of the cavern can be represented in the form of the sum of two components -- parallel and force-free fields -- and that the coefficient of expansion of the cavern in the vertical direction is much greater than in the horizontal direction. The estimates show the effectiveness of the cooling mechanism and the possibility of explaining sunspot formation on its basis. Bibliography of nine items.

[63]

#### EVENTS ON SUN DURING PERIOD 3-6 AUGUST 1972

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.462

[Abstract of article by A. F. Bachurin, A. S. Dvoryashin and N. N. Yeryushev; --, IZV. KRYM. ASTROFIZ. OBSERV., 54, 1976, pp 227-232, "Events on the Sun During the Period 3 August-6 August 1972 at Wavelengths 1.9, 2.5 and 3.5 cm"]

[Text] Data are presented on solar radioemission at wavelengths 1.9, 2.5 and 3.5 cm. These data were obtained early in August 1972 when a powerful spot group moved across the solar disk. The observations were made using the 22-m radiotelescope at the astrophysical observatory. The local radio source associated with this spot group is characterized by an unusually high density of the emission flux in the centimeter range. The day-to-day flux density did not change significantly. In the attenuating part of the powerful radioburst associated with the proton flare of 4 August 1972 there was a whole series of low-intensity bursts which followed one another. The degree of polarization at the times of the maxima of these bursts usually increased in comparison with its value in the intervals between bursts. Bibliography of five items.

[63]

#### MOTION OF LONG-LIVED SPOT GROUPS

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.481

[Abstract of article by G. P. Shchegoleva; Moscow, SOLNECHNYYE DANNYYE, No 11, 1975, pp 63-70, "Characteristics of Motion of Some Long-Lived Spot Groups"]

[Text] The article describes a method for determining the coordinates of spots on photoheliograms. The material for the investigation was solar photographs taken at the Mountain Astronomical Station of the Main Astronomical Observatory USSR Academy of Sciences (Kislovodsk) during 1966 and 1971. A study was made of the characteristic motions of two recurrent spot groups in the course of four and five solar rotations. It was established that the motion of both spot groups over a long period of time does not conform to the law of differential rotation. Their angular velocity corresponded to rotation in the Carrington coordinate system, although the latitude differed from  $15^\circ$ . In the stage of group destruction there were movements of a series of spots in a direction corresponding to differential displacement. Bibliography of six items.

[63]

#### MAGNETIC FIELDS OF SOLAR FLOCCULUS

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.455

[Abstract of article by G. B. Gel'freikh, S. D. Snegirev, V. M. Fridman and O. A. Sheyner; Gor'kiy, IZV. VYSSH. UCHEB. ZAVEDENIY, RADIOFIZIKA, Vol 18, No 12, 1975, pp 1764-1769, "Magnetic Fields of Solar Flocculus"]

[Text] The distribution of magnetic fields of a flocculus was obtained on the basis of the results of observations at the time of a solar eclipse. The radio method was used in the simultaneous measurement of two parameters of solar radioemission: polarization P (differences of two orthogonal circularly polarized components) and slope of the spectrum  $\Delta I$  (intensity difference at two close frequencies) at one wavelength. In the magnetic field distribution it is possible to discriminate sectors of smooth changes with values up to 15 gauss, alternating with sectors in which the field has a significantly greater level (up to 300-600 gauss) and experiences marked changes up to a change in polarity. Comparison of this distribution with the distribution of magnetic fields in the photosphere shows that sectors with strong fields are situated close to places over groups of pores in the photosphere. Thus, it is shown that the employed method is effective in studying low-contrast formations on the sun. Bibliography of 13 items.

[63]

#### VELOCITY FIELD IN ACTIVE REGIONS

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.441

[Abstract of article by Dzh. I. Irgashev; --, IZV. KRYM. ASTROFIZ. OBSERV., 54, 1976, pp 233-240, "Some Characteristics of the Velocity Field in Active Regions"]

[Text] On the basis of photoelectric observations in the line  $\lambda 5250$  Fe I a study was made of the velocity field in well-developed active regions located near the central meridian. On the assumption of an identical density in the flows of rising and descending gas it is demonstrated that the imbalance of flows of matter is associated with an imbalance of the magnetic fluxes in the active region. The correlation between them is dependent on the type of spot group. In an active region in places of weak longitudinal magnetic fields ( $H_{II} < 20$  gauss) there is predominantly a rising of the gas, and in places with a field strength greater than 20 gauss the subsidence of gas predominates. Estimates show that for filling in the active region the balance which exists between the flows of ascending and descending matter it is necessary that the mean density of the matter in regions occupied by weak ( $H_{II} < 20$  gauss) magnetic fields be approximately three or four times greater than the mean density of matter in the remaining part of the active region. Outside the spots the imbalance of fluxes of matter is greater in those places where the magnetic field is stronger. In the part of the active region occupied by the magnetic polarity of the dominating spot the imbalance of the flux of matter is greater and the predominance of the upwelling of the gas in places with a strength of the magnetic field  $H_{II} < 20$  gauss is expressed more strongly than in the part occupied by the magnetic field of spots of the opposite polarity. Bibliography of 14 items.

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## II. METEOROLOGY

### News

#### PAPERS ON CLOUDS, PRECIPITATION, ARTIFICIAL MODIFICATION

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B73K

[Abstract of Collection of Articles edited by A. D. Dzhurayev and V. P. Kurbatkin; Leningrad, TRUDY SREDNEAZ. REGIONAL'N. N.-I. GIDROMETEOROL. IN-T, No 30(III), Gidrometeoizdat, 1975, 176 pages]

[Text] Contents: G. Karimov -- "Statistical Analysis of Hail Phenomena in the Fergana Valley"; O. O. Dolimov -- "Information Content of Radar Data and Indication of Hail Clouds Under the Conditions of the Fergana Valley"; "Characteristics of Development of Cumulus Clouds in the Gissarskaya Valley"; Ye. I. Danov, G. M. Danova, R. P. Sal'manovich -- "Tendency to an Increase in the Parameters of Cumulus Clouds"; G. M. Danova, Ye. I. Danov -- "Influence of Some Factors on Processes of Hail Formation"; I. A. Savchenko, G. K. Sulakvelidze -- "On the Problem of Predicting Hail"; A. D. Dzhurayev, A. F. Igumentsev, T. V. Sevast'yanova -- "Determination of the Size of Hail in a Cloud Using a Single-Wavelength Radar Station"; A. D. Dzhurayev, A. F. Igumentsev, T. V. Sevast'yanova -- "Nomogram for Indicating Hail Using a Single-Wavelength Radar Station"; P. A. Bokova, A. D. Dzhurayev, T. V. Sevast'yanova -- "Some Climatic Characteristics of Hail Processes in Tadzhikistan and Adjacent Regions of Uzbekistan"; V. G. Soroka, T. V. Sevast'yanova -- "Apparatus for Determining the Statistical Characteristics of Radio Echoes"; Ye. I. Danov, G. M. Danova, I. S. Rodina, R. P. Sal'manovich, G. P. Sokol, A. A. Sherstnev -- "Results of Antihail Work in Tadzhikistan During 1972-1974"; A. D. Dzhurayev, S. S. Musayeva, V. T. Yushchenko -- "Distribution of Meteorological Elements in Stratiform Clouds of Mountainous Regions in Central Asia"; A. D. Dzhurayev, V. P. Kurbatkin, V. F. Udintsev -- "Nonuniformity of Stratiform Clouds"; G. Z. Rakhman-Zade -- "Spatial-Temporal Variability of the Upper Boundary of Stratiform Clouds"; B. A. Kamalov, Z. N. Negmatullayev, R. M. Sabitova -- "Investigation of the Intraannual Distribution of Runoff for the Purpose

of Selecting Sites for Artificial Regulation of Precipitation"; R. B. Bilyalov, I. A. Yuldasheva--"Cloud Cover Regime Over the Southern Part of the USSR"; R. B. Bilyalov, I. A. Yuldasheva -- "Spatial Distribution of Low Clouds Over the Territory of Uzbekistan"; F. A. Tyul'kina -- "Statistical Characteristics of Warm Period Rains Over the Territory of Central Asia"; T. A. Voynova, E. S. Il'inova -- "Estimating the Instability of Atmospheric Stratification in the Formation of Abundant Frontal Precipitation"; T. A. Voynova, E. S. Il'inova -- "Thermohygrometric Characteristics of Air Masses Participating in the Formation of Abundant Spring Precipitation in the Fergana Valley"; B. L. Lyapina -- "Use of Circulation Indices for Discriminating Processes With Abundant Winter Precipitation in the Fergana Valley"; B. L. Lyapina, S. M. Nabiyeva -- "Evaluation of Information Content of Different Characteristics of the Field of Ordered Vertical Currents for Use in Discriminant Analysis"; T. A. Voynova, A. N. Snitkovskiy -- "Experience in Using Discriminant Analysis for Predicting Abundant Precipitation in the Fergana Valley"; G. A. Zhirnikov, V. F. Ushintseva -- "Interrelationship of Temperature and Relative Humidity in the Ground (30-m) Layer of the Atmosphere."

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#### PAPERS ON ATMOSPHERIC OPTICS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B47K

[Abstract of Collection of Articles edited by O. A. Volkovitskiy and L. P. Semenov; Moscow, ATMOSFERNAYA OPTIKA, TRUDY INSTITUTA EKSPERIMENTAL'NOY METEOROLOGII, No 13(58), Gidrometeoizdat, 1976, 210 pages]

[Text] Contents: M. P. Kolomeyev, L. P. Semenov -- "Generation of Particles Near an Evaporating Droplet"; R. Kh. Almayev, A. F. Nerushev, L. P. Semenov -- "Propagation of Radiation in a Randomly Inhomogeneous Medium with a Regular Inhomogeneity of the Mean Dielectric Constant"; P. N. Svirunov -- "Propagation of Radiation in a Medium with Heat Patches"; D. Ye. Svetogorov -- "Formation of Zones of Clearing in Clouds and Fogs Under Conditions of Model Explosion of Droplets"; N. Ye. Kamenogradskiy, L. P. Semenov -- "Attenuation of Radiation with a Wavelength of  $0.63\mu\text{m}$  in a Clearing Zone Formed in a Liquid-Drop Medium"; R. Kh. Almayev -- "Change in the Concentration of Particles in an Aerosol Medium Under the Influence of a Gradient Force"; A. F. Nerushev, L. P. Semenov -- "Refraction of a Light Beam in a Flux of an Evaporating Liquid-Drop Medium"; A. G. Petrushin -- "Scattering Functions of Radiation at  $10.6\mu\text{m}$  with Randomly Oriented Ice Cylinders"; O. A. Volkovitskiy, V. V. Denisova, Ye. V. Ivanov, M. P. Kolomeyev -- "Experimental Investigation of the Condensation Effect Under the Influence of Radiation of a CO<sub>2</sub> Laser on Cloud Media"; O. A. Volkovitskiy, O. M. Matveyev, V. T. Pechorin, A. M. Skripkin -- "Investigation of the Rate of Clearing of the

Cloud Medium by Laser Radiation at  $10.6\mu\text{m}$ "; O. A. Volkovitskiy, N. E. Kamenogradskiy, V. K. Mamonov, L. P. Semenov -- "Transparency of a Clearable Cloud Medium"; L. G. Akul'shina, O. A. Volkovitskiy, A. F. Nerushev, V. T. Pechorin, A. M. Skripkin -- "Influence of Divergence of a Laser Beam on the Clearing of a Cloud Medium"; V. A. Bel'ts, O. M. Matveyev, V. P. Nikolayev -- "Investigation of Thermal Refraction in the Propagation of a Beam of a  $\text{CO}_2$  Laser in Fogs"; A. P. Ozerenskiy, L. M. Romanova, V. P. Snykov -- "The Light Field in a Water Fog Outside the Geometrical Zone of Propagation of a Collimated Laser Beam"; S. D. Pinchuk, A. M. Skripkin, A. A. Suplakov -- "Possibility of Using a Laser Anemometer for Determining the Characteristics of a Liquid-Drop Aerosol"; S. M. Kolomiyets -- "Characteristics of Image Transmission Through an Aqueous Aerosol Evaporable by Laser Radiation"; L. G. Akul'shina, O. A. Volkovitskiy, A. M. Skripkin, V. T. Pechorin, G. I. Shchelchikov -- "Influence of the Microstructure of the Cloud Medium on the Time of its Clearing by Laser Radiation"; V. P. Dugin, V. Maksimyuk, S. O. Mirumyants, N. K. Nikiforova -- "Anisotropy of Scattering of Light by Artificial Crystalline Cloud Formations (Vertical Illumination of Medium)"; V. P. Dugin, S. O. Mirumyants, L. N. Pavlova -- "Experimental Investigations of Backscattering of Radiation at Wavelengths of  $10.6$  and  $0.57\mu\text{m}$  by Artificial Cloud Formations"; S. M. Kolomiyets, V. P. Nikolayev -- "Method for Investigating Changes in the Angles of Incidence of Light Waves."

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## Abstracts of Scientific Articles

### PALEOGEOGRAPHIC ANALYSIS OF ENVIRONMENT

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA GEOGRAFICHESKAYA in Russian  
No 4, 1976, pp 32-39

[Article by A. A. Velichko, Geography Institute USSR Academy of Sciences,  
"Problems in Paleogeographic and Evolutionary Analysis of the Present Status of the Environment"]

[Abstract] In the dynamics of the zonal structure of nature it is probably necessary to distinguish two types of changes which can be called migrational and transformational. The migrational type reflects relatively small changes in the structure of zonality associated with fluctuations in the boundaries of the zones despite general retention of horizontal (areal) position and internal content. The transformational type reflects a marked restructuring of both the general plan of the zonal structure (appearance of the hyperzonality phenomenon) and its qualitative content, a restructuring expressed in the formation of zonal landscapes not characteristic of the present age. It can be postulated that these two types of changes are evidence of the existence of climatic variations on different scales. In the migrational type the principal characteristics of climate do change, but a latitudinal type of circulation persists. The transformational type arises with qualitatively different thermoenergetic parameters and a different circulation mechanism (predominantly meridional). The present-day zonal structure is only one of the variants of the structures of natural zonality having a broad range. Another peculiarity of the natural zonality detected in evolutionary analysis is that one and the same natural component in different climatic epochs can change its position, undergoing transition from the category of zonal components into the category of provincial components and vice versa. Paleogeographic investigations show that in the last glacial epoch the boundary of the permafrost region had a clearly expressed zonal position, as did the region of sea ice. At the present time, under different climatic conditions, these components have lost their zonal position and have passed into the category of provincial phenomena. On the other hand, forest vegetation, degraded as a zonal element in the glacial epoch, has now become a component having

a clearly expressed zonal character. All this makes it possible to say that natural components as the constituents of zonal structure have a transitory nature, that is, are capable of occupying a qualitatively different position in the zonal structure.

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#### SOUNDING OF CUMULONIMBUS CLOUDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B79

[Abstract of article by M. T. Abshayev and M. M. Zhuboyev; --, TRUDY VYSOKOGORN. GEOFIZ. IN-TA, No 31, 1976, pp 32-40, "Temperature-Wind Sounding of Cumulonimbus Clouds"]

[Abstract] The article describes the method and preliminary results of temperature and wind sounding of cumulonimbus clouds using the "Oblako" rocket employed in the hail protection service with an active radar transponder (radiosonde of the ARZ or RKZ-2 type) in the nosecone. The rocket is launched into a stipulated part of the cloud on the basis of coordinates selected using a radar operating on three wavelengths employed for simultaneous investigation of the structure and microstructure of the probed clouds. The measurements are made during the lowering of the rocket by parachute. The latter opens at a stipulated point in the cloud (a remote mechanism is used). The tracking and reception of data are accomplished using a "Meteorit" radar in an automatic tracking regime. During 1972-1973 there were about 10,000 soundings in the cloudless atmosphere (for a comparative evaluation of the quality of the collected information) and 14 soundings were made of cumulonimbus clouds, for the most part in the central part of the clouds and in the region of their radio echo maximum. The determined temperature values for the middle and upper parts of the clouds either exceed or are approximately equal to the temperature in the surrounding atmosphere at the corresponding altitude level and are always below it in the lower central part of the cloud and in the precipitation zone. In the upper and middle parts of the cloud axis one can usually observe ascending currents (5-15 m/sec), and in the lower axial part -- descending currents (2-4 m/sec). The velocity and direction of the horizontal wind components within the clouds cannot coincide with the wind velocity and direction in the cloudless atmosphere and the hodographs for the wind within the cloud and in the ambient atmosphere have a similarity only at one altitude level or another in dependence on the part of the cloud through which the rocket trajectory has passed. Bibliography of two items.

[11]

### III. OCEANOGRAPHY

#### News

#### SYMPOSIUM ON TURBULENCE AND DIFFUSION PROCESSES

Moscow OKEANOLOGIYA in Russian Vol XVI, No 4, 1976, pp 726-728

[Article by R. V. Ozmidov, "International Symposium on Investigation of Turbulence and Processes of Diffusion of Impurities in the Sea"]

[Abstract] An International Symposium on the Investigation of Turbulence and Processes of Diffusion of Impurities in the Sea was held at the Institute of Oceanology during the period 16-19 March 1976. The symposium was organized by the Coordination Center of Member Countries of the Socialist Economic Block on the Problem: "Study of Chemical, Physical, Biological and Other Processes in the Most Important Regions of the Ocean." The coordination center combines the efforts of scientists of Bulgaria, East Germany, Poland, Rumania and the USSR. The symposium was attended by about 100 scientists. Thirty-five reports were presented on the genesis and properties of small- and large-scale turbulence in the seas and oceans, diffusion of impurities, development of thermal convection, temperature fluctuations in the surface layer of the ocean and a number of other hydrophysical processes exerting an influence on the characteristics of the oceanic turbulence and structure of the impurity field. Among the subjects discussed were the following: patterns of diffusion of impurities and turbulence in the Baltic Sea, diversity of spectral forms of small-scale turbulence in the ocean and frequency of occurrence of these forms, spatial-temporal structure of turbulent field of temperature in Black Sea, characteristics of turbulence in the boundary layer adjacent to the ice cover of a water body, temperature fluctuations in the upper layer of the sea, theoretical aspects of the turbulence problem, new apparatus for investigating the small-scale structure of hydrophysical fields, diffusion of impurities artificially introduced into the sea, results of numerical computations of free convection of the surface layer of the sea. The symposia are to be held each two years in the different participating countries. The transactions of this symposium will be published by the Coordination Center in the immediate future.

[201]

## NORTHERN OCEANIC STUDIES BEING CONDUCTED

Moscow PRAVDA in Russian 21 Oct 76 p 6

[Article by A. Khramtsov: "They Study the Ocean"]

[Text] Murmansk, 20 September. Joint studies of an oceanic area in a region located between the Kola Peninsula and the polar archipelagos are being conducted aboard the scientific research ship "Akademik Kurchatov" by scientists of the Institute of Oceanology imeni P. P. Shirshov and other scientific institutes of the country.

Participants in the northern expedition have studied the special features of the hydrological conditions of two oceanographic sections which extend from the Kola Gulf to Spitzbergen and Franz Josef Land. [5]

## NOTES ON WORK OF NAVAL OCEANOGRAPHERS

Moscow KRASNAYA ZVEZDA in Russian 15 Aug 76 p 4

[Article by O. Myatelkov, "All the Oceans of the World"]

[Summary] Hydrographic and oceanographic vessels of the Soviet Navy, working in collaboration with research vessels of the USSR Academy of Sciences, are making a major contribution to study of the world ocean. The primary objects of study are the natural unstable and constantly changing thermal, dynamic, hydrochemical and other fields in the ocean. All these fields are intricately interrelated and thus the demands placed on man and instrumentation are exceedingly great. The shifting of an ocean current results in the displacement of air masses and can result, for example, in the parching drought of this year in Great Britain or an almost unprecedented cool season in Central Russia. Hence, the vital importance of studying the interaction between the ocean and the atmosphere. Navy research vessels are loaded with first-class research equipment for all-weather collection, processing and dissemination of highly important information. But the quality of training of the user of shipboard instrumentation is as important as the equipment itself. When new instruments are developed they must be made available for use as quickly as possible. In all this the oceanographer and hydrographer of the Soviet Navy is intimately interested and involved and working with zeal and often-times with courage under severe conditions, these naval specialists continue to solve problems of importance not only to the navy, but also to the national welfare as a whole.

[193]

### Abstracts of Scientific Articles

#### EFFECT OF HORIZONTAL DENSITY DIFFUSION ON INTERNAL WAVES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V122

[Abstract of article by A. Ye. Bukatov; Sevastopol', MOR. GIDROFIZ. ISSLED., No 4(71), 1975, pp 61-67, "Effect of Horizontal Density Diffusion on Internal Waves"]

[Text] In a linear formulation the author examines internal waves in an exponentially stratified sea. Use is made of the Boussinesq approximation. Depth and the Coriolis parameter are considered constant. A nonflow condition is stipulated on the bottom and kinematic and dynamic conditions are stipulated at the free surface. The inducing force is a harmonic pressure wave stipulated at the free surface. The density equation takes into account horizontal density diffusion and the diffusion coefficient is assumed to be constant. The author analyzes a solution which is periodic in horizontal coordinates and time; the dependence of the vertical component of velocity on the vertical coordinate is determined from the solution of an ordinary second-degree differential equation with constant coefficients. It is analyzed and compared with the similar problem, but without allowance for density diffusion. Conditions are obtained under which there can be generation of internal waves under the influence of pressure. The conclusion is drawn that with fixed parameters of the problem there is some limiting value of the diffusion coefficient; with greater values no internal waves are formed. Bibliography of five items.

[11]

#### INTERMITTENCE AND FINE STRUCTURE OF TURBULENCE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 6, 1976, pp 657-661

[Article by V. N. Desnyanskiy, All-Union Scientific Research Institute of Hydrometeorological Information, "Investigation of Intermittence and Fine Structure of Turbulence on the Basis of a Spectral Model"]

[Abstract] A study was made of the intermittence and fine structure of turbulence on the basis of a spectral model. Specifically, the paper examines the influence of intermittence on the structure of the higher moments of the velocity field by means of numerical analysis of model equations [V. N. Desnyanskiy, et al., "Modeling of Cascade Processes in Turbulent Currents," PRIKL. MATEM. MEKH., 38, No 3, 1974; V. N. Desnyanskiy, et al., "Evolution of Turbulence Spectra to a Similarity Regime," IZV. AN SSSR, FAO, 10, No 2, 1974"]. The theoretical conclusions drawn in the author's different papers agree with the results of numerical computations. A numerical experiment is described which illustrates the nature of the intermittence.

[143]

#### COMBINED USE OF HYDROPHYSICAL MEASURING INSTRUMENTS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V33

[Abstract of article by G. A. Tolkachenko and Yu. A. Khudyakov; Sevastopol', MOR. GIDROFIZ. ISSLED., No 3(70), 1975, pp 220-227, "Combining of Hydrophysical Measuring Instruments"]

[Text] The authors have solved the problem of combining hydrophysical instruments -- determining the combination of weighting functions  $\psi_i(\tau)$  of filters  $\Phi_i$  for which the dispersion of the difference of the output signal for the entire system is

$$y(t) = \sum_{i=1}^{N+\infty} x_i(t-\tau) \psi_i(\tau) d\tau$$

and the measured process  $x_{\text{meas}}(T)$  has a minimum. As a basis of this work the authors make optimum use of the information arriving from different sensors on one and the same or functionally related parameters. The article is accompanied by a block diagram of combining an arbitrary number of measuring instruments. On the assumption that the investigated processes and the output signals of the measuring instruments are stationary and stationarily related by random processes, the authors give the derivation of formulas for determining the dispersion, correlation function and spectrum of the measurement error in this problem. The problem is solved in a formulation closest to real hydrophysical conditions. On the basis of an analysis of the results of a special experiment (which is described), carried out in the Black Sea, it was possible to obtain a quantitative evaluation of the effectiveness of combined use of measuring instruments in the example of optimum combining of three underwater illuminance sensors into one

group. It is shown that the accuracy of the combined system can considerably exceed the accuracy of each measuring instrument. Bibliography of five items.

[11]

#### DETERMINING BOTTOM RELIEF ON ECHOGRAM

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V37

[Abstract of article by M. V. Yakobson; Moscow, VYCHISL. SEYSMOLOGIYA, No 8, "Nauka," 1975, pp 178-185, "Determining Bottom Relief on Echograms"]

[Text] A study was made of the plane problem of echo sounding: it is assumed that the signals registered on the echogram are reflected on the true bottom profile -- section of bottom relief by a vertical plane. The continuous curve  $L = [x(S), y(S)]$  in the lower half-plane is stipulated on the plane  $(x, y)$ . From the point  $\xi$  on the x-axis signals are sent in all directions within some angle  $\omega$  at the peak of the effective cone of the receiving-transmitting system. The length of the travelled path of each of the reflected signals is known. Moving along the x-axis, one obtains a set of functions  $l_1(\xi), l_2(\xi) \dots$ . Solution of the inverse problem of echo sounding is sought: restoration of the L curve using the  $l_i(\xi)$  functions. The basic assumptions are: the L curve is a graph of the piecewise-smooth function  $y = f(x)$  satisfying the condition  $|f'(x)| < 1$ . It is also assumed that everywhere, except at breaking points  $f(x)$ ;  $f(x)$  is a threefold continuously differentiable function. As a result it was found that bottom relief is restored uniquely from the echogram if the angles of the slopes are  $< 45^\circ$ . Bibliography of three items.

[11]

#### CALIBRATION OF REMOTE INSTRUMENTS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V34

[Abstract of article by S. V. Dotsenko and V. A. Ryzhenko; Sevastopol', MOR. GIDROFIZ. ISSLED., No 4(71), 1975, pp 215-224, "Optimum Calibration of Remote Instruments Using Direct Measurement Instruments"]

[Text] The authors have analyzed the possibilities of calibration of remote instruments mounted in flightcraft on the basis of readings of direct (contact) measurement instruments with point sensors. The calibration involves comparison of the signals of the remote instrument and some

linear set of signals of contact instruments. Formulas are derived which make it possible to estimate the value of the relative calibration error in dependence on the configuration of placement of the contact sensors and their number. The measured field is assumed to be uniform and isotropic; the contact and remote instruments are considered inertialess; the latter has an axially symmetric directional diagram. It is possible to determine the mean square relative errors in calibration separately for cases of use of one, two and three contact sensors. Solution of the system of equations for the case of calibration with use of three contact sensors was obtained for three variants of arrangement of the sensors. The relative calibration error is determined for remote measuring instruments with directional diagrams of different form and with different heights of instrument placement; the degree of decrease in error in relation to the number of contact sensors is analyzed; the conditions for minimizing the calibration error are determined. The results of computations are applied to an investigation of the accuracy of calibration of remote instruments used in measuring the temperature of the Black Sea. Bibliography of three items.

[11]

#### SPATIAL DEPENDENCES OF ACOUSTIC FIELD

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V154

[Abstract of article by I. A. Shatinin and K. V. Arsent'yev; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 146-149, "Use of a Correlation Criterion in Describing the Spatial Dependences of an Acoustic Field"]

[Text] A study was made of changes in the acoustic field in space in dependence on the distance between the source and receiver of acoustic energy and their relative arrangement in depth in a layered-inhomogeneous medium. As a comparative evaluation of the degree of coincidence of field characteristics the author proposes a correlation criterion. It was found that the shapes of a series of curves of the vertical distribution of acoustic pressure of a signal with different positions of the sound source in distance and depth differ substantially. For the characteristics of regions of space with respect to distance in the case of a zonal structure of the acoustic field the correlation coefficients can attain values close to 1. Modeling confirmed the feasibility of using the correlation criterion for describing the spatial dependences of the acoustic field. Bibliography of three items.

[11]



## NONSTATIONARY NON-GAUSSIAN HYDROPHYSICAL PROCESSES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V223

[Abstract of article by V. M. Kushnir; Sevastopol', MOR. GIDROFIZ. ISSLED., No 3(70), 1975, pp 167-182, "Some Problems in Measuring and Analyzing Non-stationary Non-Gaussian Hydrophysical Processes"]

[Text] Taking into account objective data and well-validated models of the mechanisms of nonstationary state of fluctuations of hydrophysical fields in the ocean, a method is proposed for evaluating the function for the non-stationary state on the basis of a current record of different processes. The article describes a measurement scheme including high-frequency filtering, for the purpose of excluding the mean value and low-frequency trends; the filter averaging band was selected two or three times greater than the boundary frequency period. The article gives expressions ensuring determination of the nonstationary state function using a sample current evaluation of the dispersion and the mean modulus of the fluctuations obtained as a result of the nonlinear operation of quadratic detection. The article gives the conditions under which the deviations of the distribution function of fluctuations from a normal law can be neglected. It is emphasized that the nonstationary state function is a manifestation of the mechanism regulating the variability of the statistical regime of fluctuation characteristics of hydrophysical fields. Bibliography of seven items.

[11]

## DEEP-WATER AUTOMATIC STATIONS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976 7V27

[Abstract of article by Yu. S. Belavin, F. I. Konstantinov and A. V. Bochkarev; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 94-108, "Deep-Water Automatic Stations for Seismic, Acoustic and Hydrophysical Measurements in the Ocean"]

[Text] The authors have analyzed theoretical data on automatic abyssal self-contained stations for registering the hydrophysical parameters of the medium. The article examines the design peculiarities of a number of such stations. Also given are the characteristics of progressive technical solutions of some problems in the field of development of research equipment for such purposes. The conclusions are drawn that automatic deep-water carrier stations of measuring apparatus are becoming the principal means for hydrophysical (including seismic and acoustic) investigations in the ocean. The instrumentation of bottom stations for seismoacoustic measurements in the infrasonic frequency range is frequently planned

taking into account the possibility of registering a complex of hydrological data (temperature, currents, hydrostatic pressure, etc.). Particular attention is being given to detection systems; the detection methods used most frequently are those based on acoustic radiation, radar and radio direction-finding methods, and also on the basis of light, acoustic and other principles. Stations have now come into use which have registry in a multichannel magnetic memory device with the most dense (informative) registry and high resolution. For correlating the collected data the stations are supplied with a precise time device. The actuating mechanisms for separating the ballast are controlled by an internal programming device, by an external acoustic command, and also emergency and reserve signalling devices. The deep-water containers are made of durable light alloys based on Al, Ti and glass. The self-contained power sources are storage batteries with a high specific energy capacity protected by a sturdy housing. Storage batteries operating at great external pressures with a matching of the current source and ballast functions are in use. Bibliography of 28 items.

[11]

#### COMPUTING CHARACTERISTICS OF OCEANOGRAPHIC FIELDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V19

[Abstract of article by Yu. S. Shumilov, S. V. Makarov and I. F. Adakhovskiy; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 109-114, "Automation of Computations of the Characteristics of Oceanographic Fields"]

[Text] The paper describes a special dispatcher, the "OKA," designed for automating the processing of masses of oceanographic information. The authors propose a method for the machine sorting of data by months, one-degree squares, stations and observation horizons. The article describes two methods for the sorting of data on the vertical distribution of an oceanographic element. It is proposed that the investigated water area be regionalized taking into account the degree of study of the variability of types of vertical distributions of elements. Also proposed is a method for the mathematical smoothing of maps. The problems involved in statistical generalization of oceanographic data are considered. A series of algorithms is used in computations for the northwestern part of the Pacific Ocean. A total of about 350,000 punched cards was introduced into the electronic computer; about 11,000 stations were included in the processing. Data on temperature and salinity were taken as a basis for computing the speed of sound using the Wilson formula with a refined correction for hydrostatic pressure. The results of computations with an electronic computer were used for regionalization of the water body and for each discriminated region and period of the year it was possible to

determine the characteristics of the speed of sound field. The results revealed a high effectiveness of the automated processing of oceanographic data with a good quality of the obtained generalized materials. Bibliography of nine items.

[11]

#### MECHANISM OF FLUCTUATIONS OF UNDERWATER ILLUMINATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian No 9, 1976, pp 993-997

[Article by V. P. Nikolayev and M. S. Khulapov, Southern Division, Institute of Oceanology, "Application of a Nonstatistical Model for Explaining the Mechanism of Appearance of Fluctuations of Underwater Illumination"]

[Abstract] The authors have developed the H. Schenck model given in "On the Focusing of Sunlight by Ocean Waves," J. OPT. SOC. AMERICA, 47, 653, 1957 by means of a transformation from the spatial distribution of the intensity of sunlight underwater to the spectrum of the time signals describing this distribution. As made clear in the exposition in this article, the principal merit of the proposed model is that it is graphic and the results are conveniently interpreted. The four figures in the text, around which the discussion centers, are: Fig. 1. Distribution of illumination in the horizontal plane under a sinusoidal wave at different depths; Fig. 2. Dependence of variation coefficient on depth for different wave steepnesses; Fig. 3. Dependence of variation coefficient on depth for different solar altitudes; Fig. 4. Spectral densities of signal characterizing the distribution of illumination under a plane sinusoidal wave at different depths. It is shown that numerical modeling gives information making it possible in general to predict the pattern of change in the spectrum of fluctuations of the underwater light field at great depths. The model makes it possible to take into account such factors as the geometrical characteristics of waves, solar altitude and angular and linear aperture of the light detector. After further elaboration the model will make it possible to take into account the influence of the high-frequency component of waves and the index of light absorption by water.

[70]

#### IV. TERRESTRIAL GEOPHYSICS

##### News

##### PAPERS ON PROCESSING GEOPHYSICAL OBSERVATIONS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7D103K

[Abstract of collection of articles; Perm', VOPROSY OBRABOTKI I INTERPRETATSII GEOFIZICHESKIKH NABLYUDENIY. SB. STATEY, No 13, UCH. ZAP. PERM. UN-TA, No 357, 183 pages]

[Text] This collection includes papers on different methodological problems in geophysical prospecting. With respect to seismic prospecting the authors examine problems in the theory and practice of the common shot point and vertical seismic profiling methods, study of anisotropic media, investigation of the properties and use of different dynamic parameters in the processing and geological interpretation of seismic data. With respect to gravimetric prospecting, the authors consider the problems of a model of a local structure, transformation of a three-dimensional axially symmetric field into a two-dimensional field, computation of normal gravity values with a high accuracy, equivalence of different "steps," null-point displacements, etc. With respect to electric prospecting the authors examine a number of problems relating to vertical electric sounding, and with respect to magnetic prospecting -- the problem of determining the depth of the lower boundary of a body, etc. In addition, notes of a debatable nature are given on different problems.

[11]

### Abstracts of Scientific Articles

#### METHOD FOR DETERMINING MAGNETOSPHERIC PULSATIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229, No 3, 1976, pp 587-589

[Article by M. B. Gokhberg, O. A. Pokhotelov and V. A. Troitskaya, Institute of Physics of the Earth, "Possibility of Determining the Structure of Characteristics of the Magnetosphere Using Ground Data"]

[Abstract] For the first time the problem of the characteristic pulsations of the magnetosphere was formulated by J. W. Dungey in PENNSYLVANIA STATE UNIV. SCI. REP., No 69, 1954. He derived two interrelated one-dimensional wave equations describing pulsations of the Alfvén and magnetosonic types. A great number of studies have been devoted to an investigation of these equations and the interpretation of some types of geomagnetic pulsations on their basis. However, their analytical solution was possible only at the price of a whole series of simplifications of the formulated problem. The authors of the article cited above present a solution of the Dungey problem which is based on ground observations of geomagnetic pulsations. They propose a possible explanation of the spatial structure of geomagnetic pulsations observed at the earth's surface -- as a reflection of the presence of the nodes and antinodes of a standing magnetohydrodynamic wave in the magnetosphere. The "corrugated" structure of the spatial distribution of the amplitude of pulsations observed at the earth's surface, that is, the alternation of maxima and minima, can be the result of appearance of a standing wave. The spatial length of the wave should be determined as double the distance between successive maxima. This conclusion is illustrated in the example of an auroral maximum.

[112]

#### FILTERS FOR DISCRIMINATING SIGNALS FROM INTERFERENCE WAVE FIELDS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229, No 3, 1976, pp 590-592

[Article by M. K. Polshkov, A. V. Nevinnyy and P. G. Gil'bershteyn, Scientific Research Institute of Marine Geophysics, "Optimum Velocity Filters for Discriminating Signals from Interference Wave Fields"]

[Abstract] Ordinary methods for discriminating signals have directivity characteristics with high levels of nonuniformity in the transmission bands and are quite ineffective in the reception of signals in wide ranges of frequencies and apparent velocities. This paper describes velocity filters which are inhomogeneous groups of elements with a total zero response ensuring an infinite gain in the reception of regular signals in the necessary dynamic range. The article discusses the synthesis of optimum velocity filters in both symmetric and asymmetric optimum groups. It is shown that a set of optimum filters with different numbers of elements makes it possible to determine filters for the reliable reception of either a packet of signals, or, with the successive subtraction of waves, to find evaluations of the parameters of interfering signals and noise.

[112]

#### TECTONIC DEFORMATION OF TERRESTRIAL SPHEROID

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR, NAUKI O ZEMLE in Russian Vol XXIX, No 2, 1976, pp 3-13

[Article by G. G. Oganezov, Yerevan Polytechnic Institute, "On the Theory of Tectonic Deformation of the Terrestrial Spheroid"]

[Abstract] The objective of this study was to ascertain what consequences arise on the earth due to motion of the poles. The problem is formulated as follows: it is assumed that during the course of some definite time the pole moves along some meridian  $20^\circ$ ; the phenomena which should accompany the motion are investigated. It is demonstrated theoretically, for example, that with rotation of the terrestrial ellipsoid by  $20^\circ$  territories occupying two-fourths of the earth's surface are uplifted above the present zero surface, whereas the territories occupying the remaining two-fourths subside. The materials presented show that it is adequate for the earth to be rotated  $20^\circ$  and in the earth's middle latitudes some considerable parts of the earth are uplifted to cold swampy elevations, whereas others sectors subside to an equal degree. Ocean waters, due to their great mobility flow down from rising sectors and fill the subsiding sectors. This for the most part explains the phenomena of regression and transgression of the seas, when the sea completely or partially withdraws from some sectors and the opposite effect is observed in others. This gives rise to a new distribution of land and water masses, in most cases exerting a reverse, "braking" effect on motion of the poles, reducing to the limit the mobility of the latter. This suggests that the most suitable method for studying the dynamics of tectonic processes is a study of transgressions and regressions.

[94]

## TECTONIC STRUCTURE OF SEA OF JAPAN

Moscow GEOTEKTONIKA in Russian No 4, 1976, pp 72-87

[Article by Ye. N. Melankholina and V. M. Kovylin, Geology Institute USSR Academy of Sciences, "Tectonic Structure of Sea of Japan"]

[Abstract] Within the confines of the Sea of Japan it is possible to define regions with different ages of the continental earth's crust, the structures of which are traced within the limits of the shelf and which are cut off sharply on the continental slope. It is shown here that a considerable part of the sea is a region of destruction of the continental earth's crust. The abyssal basins correspond to regions with a newly formed suboceanic earth's crust. Their formation is traced from the Paleogene to the present time. Figure 1 in the text is a tectonic map of the Sea of Japan; 25 regions are defined. Schematic cross sections of the crust in the Sea of Japan and Peter the Great Gulf are included. The geological and geophysical materials given in the article show that the zones of the continental slopes of the Sea of Japan cut not only individual structural elements, but also entire regions with a continental crust of different age. Individual fragments of these regions, the same as the Yamato Rise (300 km x 150 km), are discovered within the region with a suboceanic crust in the form of "microcontinents." In a number of places there is a gradual "wedging out" of the granite layer of the earth's crust and within the confines of the continental slopes -- its marked wedging out and "cutoff." The basalt layer is traced from the continental to the suboceanic regions with some reduction in the thickness, but without a change in the principal characteristics. Some magnetic anomalies having a source in the basalt layer run from the continent within the abyssal basins, as is observed, for example, to the south of Peter the Great Gulf. It is postulated that the basalt layer forms a common base for continental and marine structures; only plates of the granite layer are isolated and fragmented. The developed facts contradict the belief that the Sea of Japan has a primary oceanic origin. The paper presents strong evidence that it is of secondary origin.

[48]

## INTERPRETATION OF GRAVITATIONAL-MAGNETIC ANOMALIES

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 3, 1976, pp 73-77

[Article by O. A. Odekov, G. Begendzhev and O. K. Vasov, Institute of Physics of the Earth and Atmosphere, Turkmen Academy of Sciences, "Interpretation of Gravitational and Magnetic Anomalies in the Cis-Kopetdagskiy Downwarp"]

[Abstract] The B. A. Andreyev formula ("Relationship Between Structural Relief and Gravity Anomalies in the Case of Several Density Discontinuities," DOKLADY AKADEMII NAUK SSSR, 124, 1959) can be used in the Cis-Kopetdag'skiy Downwarp for determining the relief of the basement and Moho using gravity field values  $\Delta g$  at the earth's surface. Within the confines of this downwarp the variations of the magnetic and gravity fields, computed by the B. A. Andreyev method, can be used for establishing vertical density contacts. There is a linear correlation between depths to the basement and the Moho and the gravity field  $\Delta g$ . The same correlation is observed between the depths of the basement and the Moho. Magnetic field anomalies  $\Delta T_a$  do not correlate with the depths of the basement and Moho. There are a number of different sources responsible for the anomalies of the gravitational and magnetic fields in the Cis-Kopetdag'skiy downwarp. It was found that deep factors, especially the relief of the basement and Moho surfaces, exert the predominant influence on formation of the observed gravity field anomaly.

[71]

#### TECTONICS OF BLACK SEA PLATFORM

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, GEOLOGIYA in Russian No 3, 1976, pp 35-44

[Article by Yu. G. Morgunov, P. N. Kuprin, A. F. Limonov, A. V. Kalinin, V. V. Kalinin and B. L. Pivovarov, Marine Geology Laboratory, Moscow State University, "Tectonics of the Platform Mantle of the Northwestern Part of the Black Sea"]

[Abstract] During the period 1968-1972 specialists from the Marine Geology Laboratory and the Seismoacoustics Laboratory, Geology Faculty Moscow State University, carried out joint investigations in the northwestern part of the Black Sea. During this period the described sea area was covered with a network of seismoacoustic profiles with a total length of more than 8,000 km. Particularly interesting materials were obtained for the upper part of the platform mantle. This cover in the NW part of the Black Sea is represented by deposits of two structural stages. The lower consists of Riphean-Paleozoic deposits and has a limited extent, filling the Dnepr-Prut pericraton downwarp. The upper structural stage consists of Meso-Cenozoic deposits occurring over the territory of the entire region and lies on a heterogeneous basement. Figure 1 gives a tectonic map of the platform cover; Fig. 2 shows two geological profiles. Each of the nine mapped subregions is discussed in detail. In structural respects the NW part of the Black Sea is not a unified depression but consists of a number of individual depressions of different age superposed on a heterogeneous basement. The Odessa deep fault played a substantial role in forming the platform cover. The most ancient depression in this cover, the Moldavian depression,



was formed to the west of the fault in Early Jurassic times. At the end of the Late Jurassic - beginning of the Early Cretaceous the Moldavian depression ceased to exist and the Lower Dnestr and Babadag depressions were formed along its margins. To the east of the Odessa deep fault there are Cretaceous depressions whose history is closely associated with the history of development of mountainous Crimea. The youngest (Upper Cretaceous) depressions are associated with Early Alpine movements.  
[5]

#### HORIZONTAL INHOMOGENEITIES OF EARTH'S CRUST

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, GEOLOGIYA in Russian No 3, 1976, pp 101-108

[Article by T. I. Oblogina, Department of Seismometry and Geoacoustics, Moscow State University, "Investigation of Horizontal Inhomogeneities of the Earth's Crust on the Basis of Seismic Data"]

[Abstract] Specialists at Moscow University have worked on formulation of a theory of seismic prospecting in horizontally inhomogeneous media and on the application of this theory to solution of different geological problems; this has made possible a new approach to the interpretation of deep seismic sounding data. The article fully discusses layered models of the crust and folded-block models of the crust. The problems involved in detecting the M discontinuity on the basis of seismic data are considered. At present the existence of this discontinuity is only tacitly postulated and it is assumed that it is related either to a velocity jump or an increased velocity gradient or a layer of reduced velocities of elastic waves is associated with it. The real existence of the M discontinuity cannot be considered demonstrated in the light of modern attainments of theoretical and experimental seismology. On the basis of the findings presented in this paper the author concludes that the bottom of the crust is a zone including the level of velocity of seismic waves  $v(x,y) = 8.0$  km/sec and its neighborhood  $7.8 \leq v(x,y) \leq 8.2$  km/sec. This zone also includes reflecting boundaries of different extent which can be either conformant or nonconformant with the velocity isolines. With such a definition of the bottom of the crust there is no need to introduce any a priori assumptions concerning its relationship to the velocity jump, zone of increased velocity gradients or a layer of reduced velocities. With these considerations taken into account, the author was able to construct a cross section showing the bottom of the crust along the profile Kzyl-Orda-Dzhezkazgan.  
[5]

## EARTH'S EXPANSION AS EXPLANATION FOR GEOLOGICAL PHENOMENA

Moscow GEOTEKTONIKA in Russian No 4, 1976, pp 16-36

[Article by Yu. V. Chudinov, Central Scientific Research Institute of Geological Prospecting, "The Earth's Expansion as an Alternative to the 'New Global Tectonics'"]

[Abstract] Based on an extensive review of the Soviet and foreign literature, the author examines the possibility of adoption of the hypothesis of the earth's expansion. The theory is that the earth's surface has increased by over double during Post-Permian times. The author argues that the hypothesis of an expanding earth merits attention as a concept alternative to the "new global tectonics" (plates hypothesis) and is without many of the inadequacies of the latter. The following sections are included: hypothesis of the earth's expansion; criticism of the expanding earth hypothesis; Le Pichon objections; hypothesis of spreading of the ocean floor; spreading of the ocean floor and the expanding earth hypotheses; premises of the "new global tectonics"; plates hypothesis; fundamental contradictions of the plates hypothesis; some characteristics of formulation of the plates hypothesis; "small plates concept." It is contended that the expanding earth hypothesis is capable of completely incorporating the hypothesis of spreading of the ocean floor, doing away with many contradictions characteristic for attempts to apply the latter to an earth which does not change in size. The expanding earth hypothesis is also compatible with the pulsation hypothesis. In addition, the proposed hypothesis is considerably better for explaining specific geological phenomena than the "new global tectonics." It explains a series of common phenomena not adequately explained by other tectonic hypotheses, including the formation of geosynclines and other large depressions.  
[48]

## NEW REGIONALIZATION OF SEISMIC DANGER IN UZBEKISTAN

Tashkent STROITEL'STVO I ARKHITEKTURA UZBEKISTANA in Russian No 8, 1976, pp 1-4

[Article by V. I. Ulomov, Seismology Institute Uzbek Academy of Sciences, "Gazli Earthquake of 1976 and Regionalization of Seismic Danger in Western Uzbekistan"]

[Abstract] During recent years it has been repeatedly noted that the officially adopted map of seismic regionalization of western Uzbekistan is in many respects invalid. The critical importance of this inadequacy was pointed up by the occurrence of two significant Gazli earthquakes on 8 April and 17 May 1976. There is good basis for assuming that both events

were associated with a region of intersection of two systems of faults in the earth's crust detected by geophysical and seismological methods long before these earthquakes. Accordingly, specialists have prepared a new seismic regionalization map for this area (reproduced in the article) and a list of cities and villages in western Uzbekistan with the predicted maximum intensity of seismic events.  
[64]

#### FILTERING OF SEISMIC CROSS SECTIONS BY NOISE SUBTRACTION METHOD

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian, No 7, 1976, 7D134

[Abstract of article by V. I. Dmitriyev and G. V. Akkuratov; Moscow, ELEKTROMAGNIT. ZONDIR. ZEMLI I LUNY, Moscow University, 1975, pp 74-87, "Two-Dimensional Filtering of Seismic Cross Sections by the Noise Subtraction Method"]

[Text] The article gives an approximate solution of the problem of two-dimensional filtering of the wave field of plane waves by the noise subtraction method. The wave field is considered as a linear combination of a finite number of regular waves of an invariable form. The authors estimate the error in the method. The algorithm used with this method was tested in model examples for the wave field, being the sum of two sine curves with stipulated frequencies and a phase shift complicated by sinusoidal interference with an apparent velocity and amplitude different from the useful signal. Test results are given. A merit of the algorithm is speed and a small number of initial data.  
[11]

#### METHOD FOR INTERPRETING GRAVITY ANOMALIES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7D236K

[Abstract of brochure by A. V. Voronkov; Saratov, INTERPRETATSIYA ANOMALIY SILY TYAZHESTI PO GRAFIKAM TELESNYKH UGLOV (Interpretation of Gravity Anomalies from Solid Angle Curves), Saratov University, 1975, 71 pages]

[Text] This brochure is devoted to the development and improvement of the methods for interpreting gravity anomalies. The basis of the method, tested using an electronic computer, is the dependence of the anomalies on solid angles, which in the case of solution of the inverse problem transforms the anomaly into a straight line. On this basis the author gives quantitative expressions for evaluating the reliability and equivalence of the solution and procedures are laid out for obtaining stable and more

reliable results. For some classes of bodies (truncated cone, etc.) the article gives computed tables of solid angles. Investigations of the accuracy of solution of the inverse problem were carried out. The results of the interpretation give new data on the structure of the western part of the Caspian Basin. The applicability of the method for solving geological problems is illustrated in the example of the Lower Volga.  
[11]

#### CARBON-14 AS INDICATOR OF COSMIC-TERRESTRIAL PROCESSES

Dushanbe DOKLADY AKADEMII NAUK TADZHIKSKOY SSR in Russian Vol 19, No 7, 1976, pp 26-30

[Article by V. A. Dergachev, G. Ye. Kocharov and N. Tuychiyev, Physical-Technical Institute USSR Academy of Sciences and Astrophysical Institute Tadzhik Academy of Sciences, "Investigation of Low-Frequency Variations of Some Geophysical and Cosmophysical Phenomena"]

[Abstract] Measurement of the content of the cosmogenic isotope  $C^{14}$  in trees of known age has demonstrated the presence of distinct variations in the rate of radiocarbon formation in the earth's atmosphere. The authors have studied the relationship of variations in  $C^{14}$  content in several aspects, such as in dependence on changes in strength of the geomagnetic field. A special program was prepared for processing H values and detecting hidden periodicities in changes in H during the last 10,000 years. There was found to be an inverse correlation between changes  $\Delta C^{14}$  and the ratio  $H_{\text{past}}/H_0$  ( $H_0$  is the present strength of the earth's field). Computations show that if the fundamental period of change in the earth's magnetic field is 7,500 years with an amplitude of 0.4 oe, this can cause a change in the radiocarbon content by 5-6%. In addition, since during cold periods the  $C^{14}$  concentration in the atmosphere should increase and during warm periods it should decrease, an attempt can be made to relate the temporal change  $\Delta C^{14}$  with climatic changes. The existence of a main maximum of 65-80 years in the spectra of temporal variations  $\Delta O^{18}$  and  $\Delta C^{14}$  is evidently associated with the secular cycle of solar activity. The postulated correlation between  $\Delta C^{14}$  and solar activity affords prospects for studying solar activity in the past.  
[80]

#### OPTICAL PROCESSING OF AIRBORNE MAGNETOMETER DATA

Moscow SOVETSKAYA GEOLOGIYA in Russian No 8, 1976, pp 118-121

[Article by O. A. Potapov, USSR Geology Ministry, and Ye. F. Matveyev, Moscow Geological Prospecting Institute, "Use of Optical Processing of Airborne Magnetometer Data for Tectonic Regionalization of Folded Regions"]

[Abstract] The experience of interpreting data from a magnetic or gravimetric survey using a laser apparatus shows that there are definite advantages in optical processing in comparison with processing on an electronic computer. In contrast to the time-consuming operation of preparing punched tapes for each curve for the input of initial data into an electronic computer, the operation of preparing curves for processing on a laser apparatus is reduced to a blackening of the area between the curve and a selected base line; this operation does not require much time or high skill of the worker. The curves prepared for optical processing are subjected either to simultaneous spatial filtering or spectral-correlation analysis. Optical low-frequency filtering is equivalent to a smoothing of the initial curves and high-frequency filtering makes it possible to eliminate the influence of the low-frequency components and thus to discriminate local field components. The data obtained as a result of filtering are similar to the initial curves scaled to different levels using an electronic computer. For studying the spectral composition of the studied field and discriminating its latent periodicity there is optical spectral-correlation analysis of all the initial curves simultaneously. The final results of use of optical systems can be represented either in the form of a photograph of these optical transformations and then the interpretation has a qualitative nature, or in the form of data from photoelectric registry of the results of optical processing (quantitative interpretation of initial data). The article gives an example of a qualitative geological interpretation of the results of optical processing of airborne magnetometer data for the purpose of tectonic regionalization of folded regions (eastern part of the Altay-Sayan folded region).  
[79]

#### VERTICAL AND HORIZONTAL MOVEMENTS OF EARTH'S SURFACE

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 6, 1976, pp 75-82

[Article by A. V. Karakin, Institute of Physics of the Earth, "On the Problem of the Nature of Long-Wave Vertical and Horizontal Movements of the Earth's Surface"]

[Abstract] The author discusses the tectonic mechanism proposed by I. V. Kalashnikova, et al. ("Horizontal and Vertical Movements of the Lithosphere," FIZIKA ZEMLI, No 9, 1974) and A. V. Karakin, et al. ("Effects of the 'Lubricated Layer' Arising During Horizontal Movements of the Lithosphere," DAN SSSR, Vol 214, No 3, 1974). In this article there is application of the model of a viscous asthenospheric layer with a constant viscosity. Atop it floats a flexible nondilatatable lithospheric film moving in a horizontal direction with a stipulated velocity. The flow in the asthenosphere arising as a result of this movement leads to vertical displacements of the lithospheric film. On the basis of the nature of

the forced vertical movements of the film it is possible to judge to what degree this tectonic mechanism is applicable and what range of values of the parameters is typical for it. Quantitative information on movement of the earth's surface can be used for computing some characteristics of the model. In the paper emphasis is on the simplest types of movement corresponding to the asymptotic forms of the equation describing these movements. The article gives the derivation of an equation in the long-wave approximation describing the tectonic mechanism relating horizontal and vertical movements of the earth's surface. The dimensionality expressions following from this equation in the field of high-frequency asymptotic behavior are in reasonable agreement with data from field observations and geodetic measurements obtained for recent movements. Recent and ancient tectonic movements occur primarily in a quasistationary regime.

[75]

## V. UPPER ATMOSPHERE AND SPACE RESEARCH

### News

#### CONFERENCE ON IONOSPHERIC PHYSICS HELD IN ASHKHABAD

Ashkhabad TURKMENSKAYA ISKRA in Russian 22 Oct 76 p 3

[Turkmeninform Report: "Object of Study: Physics of the Ionosphere"]

[Text] Questions of investigating the upper layers of the earth's atmosphere are the center of attention of the All-Union Conference on Ionospheric Physics which began on 20 October in Ashkhabad.

Vice President of the Turkmen Academy of Sciences A. Karryyev opened the conference.

Director of the Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation USSR Academy of Sciences V. V. Migulin addressed those assembled.

The scientists will discuss dozens of reports on varied physical phenomena occurring in the ionosphere -- this unique natural laboratory.

"Ashkhabad has become the site for conducting such an all-union conference for the second time," Vice President of the Turkmen Academy of Sciences O. Ovezgel'dyyev told a correspondent of Turkmeninform.

"The physics of the upper atmosphere and near-earth space is one of the traditional scientific directions of the Turkmen Academy of Sciences. The results of research by Turkmen scientists have been applied in developing methods for predicting radio propagation, investigating solar radiation waves and the spectrum of meteor trails and the photochemical processes occurring in them. The foundation has been laid for application of the scientific developments on activity in the upper layers of the atmosphere in the national economy.

Today the conference will conclude its work.

# TASS ANNOUNCES LAUNCHING OF "KOSMOS-861"

Moscow PRAVDA in Russian 23 Oct 76 p 1

[TASS Report: "'Kosmos-861'"]

[Abstract] The artificial earth satellite "Kosmos-861" was launched in the Soviet Union on 21 October 1976. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.6 minutes;
- apogee, 280 kilometers;
- perigee, 256 kilometers;
- orbital inclination, 65 degrees.

# TASS REPORTS "SALYUT-5" STATION COMPLETES FOUR MONTHS IN ORBIT

Moscow PRAVDA in Russian 26 Oct 76 p 4

[TASS Report: "'Salyut-5': Four Months in Orbit"]

[Text] Flight Control Center, 25 October. The "Salyut-5" orbital scientific station, which was inserted into a near-earth orbit on 22 June 1976, is continuing its controlled flight in an automatic mode.

By 1500 hours Moscow time on 25 October the station had completed 2,005 revolutions around the earth.

At the present time the orbital parameters of the "Salyut-5" station are:

- apogee, 272 kilometers;
- perigee, 259 kilometers;
- period of revolution, 89.6 minutes;
- orbital inclination, 51.6 degrees.

According to telemetry data, all on-board systems, equipment and scientific apparatus of the station are functioning normally. The information received on the ground is being processed. [4]

# TASS ANNOUNCES LAUNCHING OF "KOSMOS-862"

Moscow PRAVDA in Russian 23 Oct 76 p 1

[TASS Report: "'Kosmos-862'"]



[Abstract] The artificial earth satellite "Kosmos-862" was launched in the Soviet Union on 22 October 1976. The satellite was inserted into an orbit with the following parameters:

- initial period, 11 hours 49 minutes;
- apogee, 39,300 kilometers;
- perigee, 610 kilometers;
- orbital inclination, 62 degrees 50 minutes.

#### GERMAN SPECIALIST EXPLAINS OPERATION OF MKF-6 CAMERA

Moscow KRASNAYA ZVEZDA in Russian 19 Sep 76, p 4

[Article by Reiner Kasper, Chief Specialist of the Karl Zeiss Jena Enterprise, "The Earth from Orbit"]

[Text] Photographing of the earth from spaceflight altitudes has become an inseparable part of manned spaceflight programs. In order to carry out the recent experiment, named "Raduga," an experimental multispectral camera was developed jointly with the Space Research Institute USSR Academy of Sciences and manufactured at the Karl Zeiss Jena Enterprise of the German Democratic Republic.

As a result of the work of specialists in the fields of optics, mechanics and electronics, an apparatus was developed that has high operational characteristics. It is capable of photographing features on the earth simultaneously in six narrow optimally selected zones of the spectrum -- four in the visible range and two in the near infrared. Thus it is possible to obtain significantly greater information about such features than would be provided by black-and-white photography.

In order to guarantee that the processing of the photographs taken simultaneously in separate channels will be of good quality, the photographs themselves must be first of all geometrically similar. This requirement is satisfied by the absence of distortion and a strict parallelism of the optical axes of the six lenses. The required synchronism of photography in all six channels is achieved by the mechanical coupling of the shutters. In order to avoid "smearing" of the image caused by the movement of the space vehicle, the MKF-6 camera is provided with an image shift compensation system. Interesting solutions were found to the problems of showing the large amount of information necessary for processing, such as time, exposure, lens opening, etc.

An electronic system is used to control the photographic cycle, mechanisms and film cassettes. Important information on the operation of the photographic system may be obtained either by telemetry from the spacecraft or directly at the control panel.

This apparatus is rather complex and its manufacture required serious effort. But through all the difficulties that arose in this work we were actively assisted by Soviet specialists. The fact that five of our engineers working on the electronics of the multispectral camera were graduates of Soviet higher technical schools contributed among other things to the mutual understanding of the group.

During the development and manufacture of the MKF-6 camera a great deal of attention was devoted to problems of inflammability, toxicology and reliability. The numerous tests made on the MKF-6 camera under different "climatic" conditions and mechanical stresses both at our facilities as well as at Soviet plants provided a guarantee of the reliability of the instrument.

The result of our joint efforts was not simply the development of the high-quality, six-channel multispectral MKF-6 camera, but also the strengthening of friendship among all who participated in this work and among our socialist countries.

#### TASS ANNOUNCES LAUNCHING OF "KOSMOS-863"

Moscow PRAVDA in Russian 27 Oct 76 p 3

[TASS Report: "'Kosmos-863'"]

[Abstract] The artificial earth satellite "Kosmos-863" was launched in the Soviet Union on 25 October 1976. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.8 minutes;
- apogee, 370 kilometers;
- perigee, 187 kilometers;
- orbital inclination, 62.8 degrees.

#### USE OF SATELLITE LASER RANGE FINDERS DISCUSSED

Riga SOVETSKAYA LATVIYA in Russian 20 Oct 76 p 3

[Article by V. Yegorov and S. Tatevyan: "Laser Range Finder"]

[Text] At Simeiz the international school for laser observation of artificial earth satellites carried out within the scope of the "Interkosmos" program has ended its work. During a 20-day period, at the Experimental Station for Observing Artificial Earth Satellites of the Astronomical Council

USSR Academy of Sciences and scientists and specialists from Hungary, GDR, Poland, USSR and CzSSR discussed the problems involved in laser ranging of satellites for solving problems in geodesy, geophysics and geodynamics; carried out practical work in the observatory; considered how to improve further the laser range finders employed.

Up to 1957 geodesy, which studies the earth's figure and dimensions and the position of geocentric coordinates of points on the earth's surface, had data available only on surface measurements of small areas, limited to the territories of individual countries or continents. That was the main reason for insufficient correlation of geodetic coordinates determined in various sectors of the earth. The use of satellites as objects for geodetic measurements significantly extended the possibilities for geodesy and still allowed for reception of valuable practical results. The method of photographic observations from space permits the determination of distance with an accuracy to several dozen meters.

The necessity for further increasing the accuracy of measurements required a search for new methods. The most promising methods are those based on the reception of reflected laser signals. In this case the time interval for transmission of a light signal for distance from the laser satellite rangefinder to the satellite and return is measured very accurately. A laser transmitter generating very short but powerful pulses continuing about one one-hundredth of a millisecond is used as the source.

The distance to the satellite can be measured with an accuracy to several centimeters.

One such rangefinder has been set up at the Simeiz Station for Observing Artificial Earth Satellites of the Astronomical Council USSR Academy of Sciences. It was created by Soviet and Czechoslovakian scientists and is used for scientific research in the field of satellite geodesy and geodynamics conducted with scientists of the socialist countries under the "Interkosmos" program. Within the framework of this program several similar laser rangefinders have been manufactured and are already active at Polish and Bolivian satellite stations due to the efforts of specialists from Hungary, GDR, Poland, the USSR and Czechoslovakia. In the near future such rangefinders will begin operation in India and Cuba.

#### AUTONOMOUS NAVIGATION METHODS ON "SALYUT-5"

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, 1975, pp 38-39

[Article by V. Kuz'menko and S. Afonin, "'Salyut-5': Perfecting of Autonomous Navigation Methods"]

[Summary] The "Salyut-5" flight program provided for a navigation experiment whose purpose was an evaluation of the possibilities of a cosmonaut in making navigation measurements using an astronomical measuring instrument during a prolonged space flight, testing new methods for carrying out astronomical measurements, investigating the accuracy characteristics of different methods for astronomical measurements and identifying astronomical reference objects in a limited field of view. Through a side window it was possible to see certain constellations, and through a window on the opposite side -- other constellations. By observing the star sky through the channel of the astronomical measuring instrument, the crew identified navigation stars which were making apparent motions in circles (as a result of motion of the station in orbit) with a center at the orbital poles. The angles between a series of stars were measured, as well as the angles between the stars and the earth's daytime horizon. The data obtained on this flight will make it possible to ascertain the means for further improvement of the characteristics of optical astronomical instruments. The choice of navigational orientation features is of great importance. Measurements of the "star-earth's horizon" angles show that here the required accuracy is not attained as a result of the random error caused by indistinctness, blurring of the earth's horizon. The use of landmarks on the earth's surface is difficult because 60-70% of the earth's surface is shrouded in clouds. The finding of new orientation features was important on the "Salyut-5" flight. For example, both Soviet and American flights have revealed that on the nighttime side of the orbit above the blurred earth's horizon it is possible to distinguish a thin layer of glow in the upper atmosphere situated at a relatively constant altitude above the earth. The existence of this rather clear upper boundary of the ashen layer makes it possible to surmise that it can be used for navigation purposes during orbital flights. The cosmonauts measured the geometrical parameters of the layer in different phases of orbital flight at nighttime, variations of the angle "star-boundary of the ashen layer" in dependence on the illumination conditions and time, and also ascertained the altitude of the layer above the earth's horizon. In addition, the cosmonauts carried out a series of measurements "star-ashen layer" and "star-earth's horizon" making it possible to compare the accuracy of solution of the navigational problem by both measurement methods. The experimental program also included investigation of the influence of conditions for a prolonged space flight on the accuracy of navigation measurements. This was done by measuring the "star-star" angles during different flight stages. This angle can be considered a standard, it being identical in both ground measurements and in measurements from aboard a spacecraft. Thus, measurements made before a launching, in comparison with measurements of the angles between these same stars from aboard the station, make it possible to judge the influence of conditions for a prolonged flight on the accuracy of a cosmonaut's actions.

[77]

## NOTES ON "ORBITA" STATIONS

Moscow PRAVDA in Russian 1 Oct 76 p 3

[Article by A. Il'in and N. Utkin: "'Orbita': Yesterday, Today and Tomorrow"]

[Summary] During the past Five Year Plan the number of televiewers in the USSR has increased by 13 million. In large part this was due to expansion and improvement of the "Orbita" system. The system went into operation on 2 November 1967; now the country has 70 of these stations serving an area with tens of millions of inhabitants. But the viewers are by no means completely satisfied with image quality or the programs which they see on their television screens. For example, people who work on the second shift at industrial plants feel that they are deprived of seeing the best programs. The news is often outdated, whereas viewers feel it could be constantly updated. The programs seem to be oriented for the big cities, with little attention being given to events in the Far North, Far East and Siberia or to programs of particular interest to people in these regions. Not only that, but transmissions frequently do not begin on time. And everything seems to be dictated from Moscow... In actuality, say the authorities, the shortage of satellite channels for the transmission of TV signals for the time being does not make it possible to relay a program in such a way that it is received at a convenient time in all time zones. Plans call for improvements by use of satellites in a stationary orbit. In combination with the "Molniya-3" satellites they will make it possible to transmit Central Television programs to remote regions of the country at a more convenient time. The zone of reliable reception of a color image will also be widened. In addition, the problem of transmitting TV programs in different hour zones taking into account local time and other conditions will be facilitated by the technical means created for the 1980 Olympics; all the facilities used for transmitting the Olympics will later be used in upgrading national television. Long-range plans are nice, but there is much to do even now. For example, the Tura "Orbita" station was put into operation in the Evenkiyskiy National Okrug a year ago. The equipment which was lacking a year ago is still lacking; personnel are inadequate; living quarters do not suffice. In bad winter weather the outlying personnel cannot get to the station because the half-track vehicle they once had has been taken away. Worst of all, there are no measuring instruments for monitoring the quality of the received image. Is this an isolated example? No, the same situation prevails at Abakan, Boguchany, Kyzyl, Yakutsk... And in many areas TV receivers are not available for purchase even by those with the desire and the money.

[36]

## GROUND SAMPLING OPERATIONS OF THE "LUNA-24"

Moscow PRAVDA in Russian 13 Oct 76 p 3

[Article by S. Sokolov, V. Barsukov and B. Vladimirov, "Along the 'Earth-Moon' Trajectory"]

[Summary] The carrier-rocket with "Luna-24" was launched from Baykonur on 9 August 1976. Within 15 minutes after its lunar landing on 18 August a radio signal from the earth had activated its ground-sampling mechanism. The latter was a qualitatively different type of space drill rig differing considerably from those carried by "Luna-16" and "Luna-20." It was designed for drilling into a wide variety of ground materials -- from solid rock to loose pulverized material containing individual rocky inclusions. After return to the earth, specialists at the Institute of Geochemistry and Analytical Chemistry photographed the ground by X-ray through the container and also for the entire length of the column obtained the photometric characteristics in different light of the visible and IR ranges. The magnetic characteristics of the ground were also determined. This made it possible, on the basis of the content of metallic iron, which is formed for the most part under the influence of the solar wind, to judge roughly concerning the time of exposure of different sectors of the column at the lunar surface. After comparing these data with curves of energy expenditures on drilling and the rates of penetration it was possible to distinguish sections of the column for investigating the petrographic, physical and chemical properties. The total weight of the transported ground, 170 grams, was completely adequate for its detailed study. On the basis of the color of the regolith in the column it was possible to discriminate six principal layers. They all originate from regions of occurrence of dark basaltic (volcanic) rocks filling the basin of the Sea of Crises, but in a number of sectors there are also large fragments of intrusive rocks and an admixture of ancient continental material. Detailed study of individual layers in the column makes possible an evaluation of the conditions at the time of their formation. It can be said with assurance that the "Luna-24" column reveals the history of the moon over a period of two or three billion years. Therefore, its investigation will help in finding an answer to very important problems relating to the formation, structure and development of planets of the solar system. Until now scientists have assumed that the earth's crust was formed later than the birth of the planet itself. But unexpectedly it was discovered that the very ancient continental lunar crust almost coincides with the age of the moon itself -- 4.5 billion years. Such ancient rocks have yet to be discovered on the earth. But it is not impossible that the earth's primary crust owed its origin to a similar process. Thus, lunar research is leading to a reexamination of theories on the earth's origin and evolution.

[68]

### Abstracts of Scientific Articles

#### PERTURBED MOTION OF CHARGED ARTIFICIAL EARTH SATELLITE

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 3, 1976, pp 49-52

[Article by Yu. M. Manakov, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Perturbed Motion of Charged Artificial Earth Satellite"]

[Abstract] Work is continued on allowance for the dependence of perturbations in the motion of artificial earth satellites on many factors whose influence has previously been neglected. In this paper it is shown that the interaction between a satellite having a charge and the earth's magnetic field can be expressed in the influence exerted on the artificial earth satellite by the Lorenz force. Formulas are derived for a first-approximation evaluation of the satellite charge and also formulas for computing the secular perturbations in orbital elements from the Lorenz force. Evidently, it would be useful to install on the artificial earth satellite an instrument for measuring the satellite potential relative to neutral plasma. This will help in clarifying some uncertainty in the AES potential. It might be possible to increase the satellite potential artificially to a level of about  $10^6$  V; this will make it possible to detect perturbations from the Lorenz force. The AES charge can be ascertained from the Lorenz force. And since the satellite charge is a function of the concentration of charged particles and their temperature, on the basis of observations of the AES it is possible to obtain important parameters of circumterrestrial space.

[45]

#### TRANSMISSION OF PHOTOIMAGE WITH "NEVA" APPARATUS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 3, 1976, pp 55-59

[Article by B. A. Novakovskiy, V. O. Kersha and V. F. Sharov, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Geometric Accuracy of Transmission of a Photographic Image Using 'Neva' Phototelegraphic Apparatus"]

[Abstract] The photographic images obtained using the "Neva" phototelegraphic apparatus are primarily for information purposes, but emphasis is now on the extraction of measurement information. The paper cited above is therefore devoted to study of the geometric quality of such photographic images. Figure 1 in the text is a block diagram of the "Neva" apparatus; the text describes it in detail. This instrument ensures a quality of the received image characterized by a resolution of 5 lines/mm. The image obtained as a result of scanning with the "Neva" system is shown to have geometrical distortions of predominantly a systematic nature which can be excluded by the introduction of appropriate corrections.

[45]

#### ADVANCES IN COSMIC RAY STUDIES

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 40, No 5, 1976, pp 882-885

[Article by S. N. Vernov, "Foreword"]

[Abstract] The article cited above is the leader to the entire issue of this journal, which contains papers from the All-Union Conference on Cosmic Ray Physics held at Samarkand during the period 29-31 October 1975. In this foreword Vernov emphasizes the two principal scientific results which have been obtained during the two years since the last conference was held, those which in the near future will determine many of the principal directions in further research in the field of space physics and nuclear physics. One of these is long-term continuous investigations of the correlation between the intensity of cosmic rays and solar activity. One of the aspects of study of the 11-year cycle of cosmic rays is the investigation of the relationships between the intensity of cosmic rays and the parameters of solar activity. In this field great progress has been attained by a group from the Physics Institute and the Scientific Research Institute of Nuclear Physics; they have been carrying out investigations on the basis of an analysis of continuous cosmic ray measurements in the stratosphere at different geomagnetic latitudes, including in Antarctica. It was possible to establish a correlation between the intensity of cosmic rays and the number of spot groups on the sun and their heliolatitude. It is found that the time shift between solar activity and cosmic ray intensity is one to three months. This led to important conclusions concerning the dimensions of the region of 11-year modulation (about 10 a.u). There is a correlation between the intensity



of cosmic rays and the heliographic latitude of spots on the sun. A new phenomenon has been discovered in cosmic rays: an impairment in the earlier established correlation between the parameters of solar activity and the intensity of cosmic rays. The second important development concerns the nuclear physics aspect. There is an impairment in scale invariance in adron interactions at superhigh energies.

Table

Проблемы A	B Установка и область энергии, Гэв				
	ИСЗ ( $10^4-10^5$ ) C	«Памир» и страто- сфера ( $10^6-10^7$ ) D	«Адрон» (высоты гор) ( $10^8-10^9$ ) E	«Широкие атмосфер- ные ливни» ( $10^9-10^{10}$ ) F	«Якутск» ШАЛ ( $10^9-10^{10}$ ) G
H Эффективное сечение	+	+	+		
I Множественность	+	+	+	+	+
J Масштабная и изотопическая инвариантность	+	+	+	+	+
K Поиски кварков, W-бозона, монополя Дирака и др.	+		+	+	
L Поиски коллективных взаимодействий $p$ - ядро и ядро - ядро	+				
M Существование тяжелых ( $M \approx 20 M_p$ ) и сверхтяжелых ( $M \approx 200 M_p$ ) кластеров	+	+	+		
N Состав и спектр первичных космических лучей	+			+	+
O Поиски дискретных источников космических лучей с энергией $10^9-10^{11}$ Гэв					+

A) Problems; B) Apparatus and energy region, GeV; C) Artificial earth satellite; D) "Pamir" and stratosphere; E) "Adron" (mountain elevations); F) "Extensive atmospheric showers"; G) "Yakutsk" extensive atmospheric showers; H) Effective cross section; I) Multiplicity; J) Scale and isotopic invariance; K) Searches for quarks, W-bosons, Dirac monopole, etc.; L) Searches for collective interactions p-nucleus and nucleus-nucleus; M) Existence of heavy ( $M \approx 20 M_p$ ) and superheavy ( $M \approx 200 M_p$ ) clusters; N) Composition and spectrum of primary cosmic rays; O) Search for discrete sources of cosmic rays with energy  $10^9-10^{11}$  GeV

At the present time specialists in a number of laboratories are carrying out much work for creating new apparatus for investigating cosmic rays with superhigh energies in space, in the stratosphere, in the high mountains and at sea level. The table shows what range of scientific problems in the nuclear physics aspect must be solved using the new apparatus.

[92]

## THERMAL SOUNDING OF ATMOSPHERE FROM SATELLITES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 12, No 9, 1976, pp 906-911

[Article by V. I. Drobyshevich, Siberian Division, Computation Center USSR Academy of Sciences, "Thermal Sounding of Atmosphere from Satellites in Range  $\lambda \sim 5$  mm in a Dry Cloudless Atmosphere"]

[Abstract] The millimeter range has a whole series of advantages for thermal sounding in comparison with the IR range. These advantages include the far lesser variability of oxygen in comparison with carbon dioxide, the far greater transparency of clouds, the extremely small contribution of water vapor and the possibility of using the monochromatic approximation. In this paper the author first describes the direct problem and then solves the inverse problem. Thus, in the problem of restoration of the vertical temperature profile on the basis of measurements of outgoing radio emission in the band 5 mm the article discusses the following problems: algorithm for solution of the incorrect problem, formulation of an iteration method, choice of the effective measurement frequencies. Numerical experiments were carried out and for the selected measurement frequencies the error in temperature restoration in the layer 0-12 km is equal to 1.5°K with a measurement error 0.4°K.

[70]

## INVERSE PROBLEMS IN ATMOSPHERIC OPTICS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 12, No 9, 1976, pp 912-920

[Article by O. M. Pokrovskiy and A. R. Stires, Leningrad State University, "On One Class of Inverse Problems in Atmospheric Optics"]

[Abstract] The authors have formulated the problem of indirect determination of transmission functions for the real atmosphere in the IR spectral region. The use of simultaneous measurements of outgoing radiation in the absorption bands of several gas components in the atmospheric transparency window creates the prerequisites for solving the problems in remote sensing without the availability of information on temperature distribution. The initial mathematical model is examined. The author discusses problems in which the use of the proposed approach is of the greatest interest. The article gives examples of restoration of the transmission functions relating to the rotational band of water vapor.

[70]

## VERTICAL PROFILES OF SMALL GAS COMPONENTS IN ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 9, 1976, pp 921-929

[Article by Yu. M. Timofeyev and V. V. Rozanov, Leningrad State University, "Use of Measurement of Outgoing Thermal Radiation for Determining the Vertical Profiles of Small Gas Components in the Atmosphere"]

[Abstract] On the basis of numerical experiments the authors examine the possibilities of determining the vertical profiles of small gas components on the basis of measurements of outgoing thermal radiation on slant paths. A method is proposed for excluding the influence of temperature in solving the problem of determining the gas composition of the atmosphere with a mean accuracy of  $0.8^{\circ}\text{K}$ . The limiting accuracy of the method for solving the inverse problem relative to the content of such gas components as  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ,  $\text{O}_3$  and  $\text{HNO}_3$  is 4-7% in the altitude range 20-48 km and 15-20% in the altitude range 12-20 km. The mean errors in restoration for the modern level of random measurement errors attain 50% for altitudes 40-48 km and 25-30% for altitudes 12-40 km.

[70]

## LONG-RANGE FORECAST OF MONTHLY MEDIAN $f_0F_2$ VALUES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 633-637

[Article by T. N. Vasil'yeva, G. S. Ivanov-Kholodnyy, V. V. Katyushina, T. S. Kerblay and V. V. Makeyev, Institute of Applied Geophysics and Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Evaluation of the Probable Success of Long-Range Forecasting of the Monthly Median Values of  $f_0F_2$ "]

[Abstract] The paper presents the results of an evaluation of the accuracy of the currently used method for the long-range forecasting of the monthly median values of the critical frequencies of  $f_0F_2$  for a stipulated level of solar activity. The checking was carried out by comparison of predicted  $f_0F_2$  with the values observed by the world network of ionospheric vertical sounding stations. The mean deviations for the observed values from the predicted values do not exceed 0.5 MHz, or 5-10% in relative units. The standard deviations are  $\sim 1.0$  MHz or 10-15%. There was no clear dependence between the independent values and the level of solar activity, season, latitude and local time.

[70]

## ELECTROSTATIC FIELD IN RAREFIED PLASMA BEHIND MOVING BODY

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 795-798

[Article by E. A. Zel'dina, V. A. Semenov and V. A. Shuvalov, Dnepropetrovsk Division, Mechanics Institute, Ukrainian Academy of Sciences, "Structure of the Electrostatic Field in the Wake Behind a Body in a Flow of Rarefied Plasma"]

[Abstract] The article gives a numerical solution of the problem of flow of equilibrium low-density plasma around a cylinder in a case when in the wake behind the body the influence of the electric field on the motion of ions is important. Computations were made for different Mach numbers and  $\xi = R/\lambda_d$  ( $R$  is the linear dimension of the body,  $\lambda_d$  is the Debye radius and  $\xi$  is electric field potential. The results of computations show that when  $\xi \lesssim 35$  the solution of the problem is already insensitive to the influence of ion focusing. This result can be interpreted as a limiting condition characterizing the influence of focusing of ions in the wake behind the cylinder, although it is somewhat greater than the similar condition  $\xi \approx 20$  obtained by A. R. Martin in PLANET. SPACE SCI., 22, 121, 1974. The data in this paper, in combination with the results given by V. A. Shuvalov, et al. (GEOMAGNETIZM I AERONOMIYA, 15, 627, 1975), can be regarded as an approximate solution of the problem of the structure of the electric field in the wake behind a cylinder in a supersonic flow of equilibrium low-density plasma for a broad range of  $S_i$  and  $\xi$  parameters.  
[83]

## IONOSPHERIC REACTIONS TO CHANGES IN ELECTRIC FIELDS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 830-836

[Article by M. G. Deminov and V. P. Kim, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Ionospheric Reaction to Rapid Change in Large-Scale Electric Fields. I. Atomic Ions"]

[Abstract] During the time of magnetic bays electric fields can increase over a period of about 100 seconds and then change far more slowly. Neglecting the initial phase of the disturbance, in the first approximation one can speak of a stepped activation of electric fields. In this study the authors have used analytical methods to analyze the reactions of concentrations of atomic ions  $O^+$ ,  $N^+$ ,  $He^+$  and  $H^+$  to the stepped change in large-scale electric fields applicable to the middle latitudes. In order to discriminate this effect it was assumed: a) that all the parameters of the medium, other than the concentrations of charged particles and large-scale electric fields which are activated at the time  $t_0$  and then remain constant do not change during the entire course of the considered process; b) that the ionosphere consists only of atomic ions  $O^+$ ,  $N^+$ ,  $He^+$ ,  $H^+$ , electrons and

neutral particles, the temperatures of which are constant; c) that the drift motions of charged particles due to thermospheric winds are insignificant. The reaction of the concentration of these ions is considered taking into account diffusion, electrodynamic drift and ionization-recombination processes. It is shown that the characteristic time of the reaction increases with an increase in altitude and at altitudes where diffusion is the predominant process becomes almost constant.

[83]

#### ELECTROSTATIC FIELD IN WAKE BEHIND SPHERE IN PLASMA

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 603-607

[Article by V. A. Shuvalov and E. A. Zel'dina, Dnepropetrovsk Division, Mechanics Institute Ukrainian Academy of Sciences, "Structure of the Electrostatic Field in the Wake Behind a Sphere in a Flow of Equilibrium Low-Density Plasma"]

[Abstract] The article cited above is a variant of the problem considered by the author and others in GEOMAGNETIZM I AERONOMIYA, Vol XVI, No 5, 1976, pp 795-798. For satellites moving in ionospheric plasma and in the modeling of their flight under laboratory conditions a flow regime is observed when in the near wake behind a body the influence of the electric field of the wake on the motion of ions is important. The structure of the electric field in the wake in this case is described by the system of equations for a self-consistent field. Using this system as a point of departure, the authors examine two models of numerical solution of the problem of flow of rarefied plasma around bodies at supersonic velocities when the effects of influence of the electric field on ion motion are important. The results of numerical calculations are given.

[73]

#### MONOGRAPH ON SOLAR-TERRESTRIAL RELATIONSHIPS

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.509

[Abstract of monograph by L. R. Rakipova (editor); Leningrad, SOLNECHNO-ATMOSFERNYYE SVYAZI, TRUDY GLAVNOY GEOFIZICHESKOY OBSERVATORII, No 355, Gidro-meteoizdat, 1975, 132 pages]

[Text] This new monograph deals with the problems involved in the manifestation of solar activity in thermal and dynamic atmospheric macroprocesses and climatic changes. There is a discussion of the physics of the mechanisms of the effect of solar activity on the lower atmosphere. Also examined are the problems of numerical modeling of the dynamics and energetics of the stratosphere and investigation of periodic and cyclic changes in macroprocesses in the earth's atmosphere and solar activity.

[63]

#### CAPTURE OF HIGH-ENERGY ELECTRONS DURING SUBSTORM

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 889-894

[Article by B. V. Rezhenov and V. G. Vorob'yev, Polar Geophysical Institute, Kola Affiliate USSR Academy of Sciences, "Dynamics of the High-Latitude Boundary of Capture of High-Energy Electrons During a Substorm"]

[Abstract] The objective of this study was a detailed investigation of the behavior of the high-latitude capture boundary for high-energy electrons at the time of a substorm during the early evening (1500-1800 LT) and midnight (2200-0300 LT) sectors in dependence on the substorm phase. For studying the behavior of this boundary the authors used data from the "Kosmos-426" satellite for 22, 23 and 24 November 1971. The capture boundary was determined from the decrease in the fluxes of trapped electrons with  $E = 63 \pm 16$  keV. It was found that in the preparatory phase of the substorm the boundary for capture of high-energy electrons with  $E = 63 \pm 16$  keV in the midnight sector is displaced toward the equator, attaining the minimum latitude near  $T_0$ . The mean velocity of the displacement is  $\sim 200$  m/sec. After the onset of the substorm the capture boundary in the midnight sector moves poleward with a mean velocity  $\sim 500$  m/sec. In the evening sector the capture boundary moves equatorward in the active substorm phase. The capture boundary correlates particularly well in its movement with the development of a positive bay. As a positive disturbance develops the capture boundary in the evening sector is displaced toward the equator with a mean velocity  $\sim 350$  m/sec and there is a tendency to return poleward with a restoration of the bay. The estimates show that the drift of high-energy electrons along the deformed lines  $B = \text{const}$  is capable of explaining the appearance of high-energy electrons in the high latitudes of the midnight sector.

[83]

#### NOISE STORMS, VLF EMISSION AND MAGNETOSPHERIC RING CURRENT

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 930-933

[Article by N. I. Fedyakina and Ye. F. Vershinin, Space Research and Aeronomy Institute, Yakutsk Affiliate Siberian Department USSR Academy of Sciences, "Correlation Between Noise Storms in VLF Emission and the Magnetospheric Ring Current"]

[Abstract] In this communication the authors examine series of noise storm bursts with a duration from 4 to 16 hours in the frequency range 0.8-11 KHz. Data were taken for Yakutsk for the year 1971. During this

period noise storms were observed at any time of day but most frequently they were noted at 0600-1200 LT. The correlation between noise storms and magnetic field disturbance was analyzed by the superposing of epochs method. The disturbance indices used were the values for the equatorial  $D_{st}$  variation and the planetary index  $a_p$ . The time of onset of the noise storm was used as the zero hour. The data on  $D_{st}$  variations cited in this paper, as well as the statistics on auroral activity and riometer absorption during noise storms, indicate the existence of an integral complex process in the course of whose development there is an energy redistribution between the zone of DR currents and the auroral zone. More than a small role is played by electromagnetic waves in the VLF range. The results of simultaneous measurements of the parameters of electron fluxes and VLF emission on the OGO-5 satellite gave quite convincing proof that intensive VLF waves are responsible for strong pitch-angle diffusion of electrons with  $E > 50-80$  keV.

[83]

#### PROPAGATION OF SW SIGNALS -- MOSCOW TO INDIAN AND ATLANTIC OCEANS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 841-846

[Article by V. V. Belikovich, N. P. Ben'kova, V. F. Bryantsev, G. V. Bukin, S. N. Matyugin, A. A. Protashchik and V. A. Cherepovitskiy, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Results of Measurements of the Angles of Arrival of SW Signals on the Paths Moscow - Indian and Atlantic Oceans"]

[Abstract] Data are presented from an experiment for investigation of the angles of arrival of SW signals in the horizontal and vertical planes on the paths Moscow - Indian and Atlantic Oceans. The study was for the period October 1973 - April 1974 using the scientific research ships of the Space Research Institute "Borovichi" (Indian) and "Nevel'" (Atlantic Ocean). A series of conclusions was drawn concerning the deviation of signal trajectories from a great circle in dependence on distance, time of day, season and magnetic activity. 1) with an increase in distance to the transmitter (from  $\sim 4,000$  to  $9,000$  km) there is an increase in the scatter of lateral deviations of SW radio signals; at the same time there is a predominance of signal propagation along the arc of a great circle. 2) there are definite diurnal and seasonal patterns of  $\Delta P$  (deviation of the received signal from the true azimuth of the transmitter) of SW signals probably caused by changes in the horizontal gradients of electron concentration along the paths. 3) with distances to the transmitter exceeding  $6,000$  km there was an increase in the scatter of  $|\Delta P|$  values with an increase in the  $K_p$  index (for  $|P| > 2.6^\circ$ ); this is possibly associated with the scattering of radio waves on nonuniformities of electron concentration located in the equatorial regions. 4) the most probable value

of the angles of arrival of signals in the vertical plane was 10-12°.  
[83]

#### CHANGES IN LENGTH OF DAY, EARTH'S SEISMICITY AND GEOMAGNETIC MOMENT

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 858-861

[Article by Yu. D. Kalinin and V. M. Kiselev, Physics Institute imeni L. V. Kirenskiy, Siberian Department USSR Academy of Sciences, "Solar Causation of Changes in Length of Day, Earth's Seismicity and Geomagnetic Moment"]

[Abstract] In an earlier study (GEOMAGNETIZM I AERONOMIYA, 15, 170, 1975) the author gave an analysis of the correlation between changes in solar activity, rate of the earth's daily rotation and seismicity and the conclusion was drawn that an increase in solar activity after 13 years leads to an increase in daily rotation and after 24 years there is an increase in seismic activity. The author has now continued his research and in this paper examines the correlation between secular changes in the mean annual values of Wolf numbers, velocity of the earth's daily rotation, energy of seismic activity and the second derivative of geomagnetic moment. It is shown that an increase in solar activity after 25 years leads to an increase in seismic energy, after 31-34 years there is a decrease in the velocity of the earth's diurnal rotation, and finally, after 26 years there is an increase in the second derivative of the earth's magnetic moment.  
[83]

#### PREDICTING DEVELOPMENT OF SOLAR COSMIC RAY FLUXES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 592-598

[Article by T. M. Bezruchenkova, M. N. Nazarova and N. K. Pereyaslova, Institute of Applied Geophysics, "Use of an Isotropic Diffusion Model for Predicting the Development of Solar Cosmic Ray Fluxes in the High-Latitude Zones of the Earth's Magnetosphere"]

[Abstract] The article cited above analyzes the possibility of using a model of isotropic diffusion in which the diffusion coefficient is  $\gamma = \gamma_s (r/r_s)^\beta$ . It is shown that the isotropic diffusion model can be used for predicting the development of fluxes of protons on the basis of the first two or three measurements of the fluxes in the isotropization stage, that is, for fluxes of protons from flares on the sun's western hemisphere two to five hours after the onset of injection and for proton fluxes from flares on the eastern hemisphere of the sun virtually from the onset of registry of the fluxes. The accuracy of the predicted fluxes in comparison with those measured at the maximum of the event is  $\sim 5-30\%$ . If the prediction of the fluxes is



made using the first measured values of the proton flux in the isotropic stage for several days in advance, the accuracy of the prediction in the stage of a dropoff of the fluxes is reduced considerably and is dependent on disturbance of the interplanetary medium and magnetosphere. If there is a strong magnetic storm ( $K_p = 7-9$ ), the predicted fluxes during the post-storm period can be exaggerated in comparison with the actually measured values by 1-2 orders of magnitude (the magnitude of the discrepancy is dependent on storm intensity).

[73]

#### EFFECT OF POWERFUL RADIO WAVES ON FORMATION OF $E_s$ LAYER

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 638-641

[Article by Yu. A. Ignat'yev and Z. N. Krotova, Radio Physics Scientific Research Institute, "Effect of Powerful Radio Waves on the Formation of the Middle-Latitude  $E_s$  Layer"]

[Abstract] A study was made of the influence of heating of the ionosphere by the field of a powerful radio wave on formation of the  $E_s$  layer. Within the framework of wind shear theory the authors have computed the influence of artificial heating of electron gas on the maximum electron concentration and the width of the middle-latitude  $E_s$  layer, taking into account dynamic and photochemical processes for atmospheric and metallic ions. It is shown that with heating of the electron gas by the field of a powerful radio wave the maximum electron concentration in the formed  $E_s$  layer decreases, but the width of the layer increases. This is attributable to the fact that the  $E_s$  layer is formed under daytime conditions for the most part from metallic ions. For these same ions the diffusion processes are much more important than photochemical processes by virtue of the extremely slow process of disappearance of atomic ions due to ion-exchange reactions and radiative recombination. An increase in electron temperature leads to an intensification of the diffusion process, which impedes the redistribution of ionization and formation of the  $E_s$  layer.

[73]

#### IONOSPHERIC DISTURBANCES IN MIDDLE LATITUDES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 666-673

[Article by R. Knuth and I. Wuerzberger, Electronics Institute German Academy of Sciences and Central Institute of Solar-Terrestrial Physics German Academy of Sciences, "Ionospheric Disturbances in the Middle Latitudes Caused by High-Energy Particles"]

[Abstract] On the basis of a multisided analysis of ionospheric, magnetospheric and interplanetary observations during the period of and after the solar-terrestrial disturbance of 8 March 1970 the authors examine phenomena in the lower ionosphere in the middle latitudes. The passage of a brief shock front of low-energy interplanetary plasma several hours after an SC storm is accompanied by ionization anomalies as far as  $\Phi \sim 50^\circ$ . An aftereffect in the long-wave region developed four days after the storm and lasted about nine days. The following conclusions can be drawn with respect to the course of disturbance in the lower ionosphere in the middle latitudes. The development of a solar shock front initially causes an intensification of leakage of magnetospheric particles at  $L \approx 4$  which after a SSC are mixed rapidly with magnetospheric plasma directly penetrating from interplanetary space. However, the strongest effect in the zone of geomagnetic latitudes  $55^\circ$  is exerted by a shock wave, appearing several hours after the SSC in the solar plasma cloud, which could be observed only in measurements of low-energy plasma. This solar plasma cloud, which could be called "a moving piston," causes a brief density increase in plasma affecting the earth's atmosphere and is probably the reason for the second phase of a geomagnetic storm during which there can be propagation of anomalous ionospheric ionization to geomagnetic latitudes  $\sim 50^\circ$ . The prolonged aftereffect arising in the region several days after a strong magnetic storm is in turn a result of a prolonged displacement of the maximum of the outer radiation belt from  $L \approx 4$  to  $L \approx 3$  with a simultaneous maximum intensity increase. Ionization anomalies are caused primarily by descending high-energy electrons.

[73]

#### ANOMALOUS IONIZATION IN THE HIGH-LATITUDE E REGION

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 723-726

[Article by A. S. Besprozvannaya and T. I. Shchuka, Arctic and Antarctic Scientific Research Institute, "Distribution of Anomalous Ionization in the E Region in the High Latitudes According to Surface Sounding Data"]

[Abstract] The entire high-latitude region can be divided into two parts: the polar cap and a zone approximately coinciding with the auroral zone. Both of these regions have their peculiarities in the behavior of different characteristics of anomalous electron density. The probability of appearance of anomalous ionization has little dependence on the level of solar and geomagnetic activity. With both a quiet and a disturbed magnetic field there is a high probability of the appearance of an increased electron concentration in the zone, whereas a very low concentration is observed in the polar cap. An increase in geomagnetic disturbance leads only to some change in the position of the zone of high probability and an extremely insignificant increase in maximum values. Changes in solar activity exert no significant effect on the position of the zone under quiet magnetic

conditions, although the region of the maximum within it is somewhat more extensive. Under disturbed conditions the transition from the minimum to the maximum of the solar cycle also exerts an influence on the extent of the region of maximum values and in addition is manifested in some movement of the southern boundary to lower latitudes. In the polar cap in all cases the anomalous ionization does not exceed  $(1.2-2.0) \cdot 10^4$  electrons/cm<sup>3</sup>. In the zone an increase in magnetic activity leads to an increase in electron density by approximately three or four times. Under nighttime and morning conditions the values attain  $3 \cdot 10^5$  electrons/cm<sup>3</sup> and in the near-midday sector --  $1.2 \cdot 10^5$  electrons/cm<sup>3</sup>. It can be concluded that the anomalous electron concentration in the E region is determined primarily by the injection of charged particles.

[73]

#### REFRACTION COEFFICIENT DETERMINED BY RADIOSONDE

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.178

[Abstract of article by V. I. Sergiyenko; --, ASTROMETRIYA I ASTROFIZIKA. RESP. MEZHVED. SB., No 28, 1976, pp 66-78, "Investigation of the Atmospheric Refraction Coefficient Using Radiosonde Observations"]

[Text] The author gives comparisons of the values of the refraction coefficient (index)  $n$ , computed using six modern methods. The computations were made using a Minsk-32 electronic computer by means of the author's program. Data from radiosonde observations at six stations near Irkutsk were used. The author investigated the dependence of  $\Delta n$  on azimuth and their correlation with data obtained using two astrolabes. Bibliography of 24 items.

[63]

#### COSMIC RAYS IN STRATOSPHERE AND CIRCUMTERRESTRIAL SPACE

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.493

[Abstract of article by A. N. Charakhch'yan, G. A. Bazilevskaya, Yu. I. Stozhkov and T. N. Charakhch'yan; Moscow, TRUDY FIZICHESKOGO INSTITUTA AN SSSR, 88, 1976, pp 3-50, "Cosmic Rays in the Stratosphere and Circumterrestrial Space During the Period of the 19th and 20th Solar Activity Cycles"]

[Text] A study was made of the temporal and spatial characteristics of the intensity of galactic cosmic rays during the period 1958-1974 on the basis of measurements in the stratosphere. The article gives an analysis of the planetary distribution of the intensity of cosmic rays. The fluxes of

primary cosmic rays and albedo are determined. Also examined are the problems involved in the influence of solar activity on cosmic rays. The authors demonstrate the role of a heliolatitudinal distribution of sunspots in the modulation of cosmic rays. The anomalous increase in cosmic ray intensity in the energy interval 0.1-1.5 GeV in 1971-1973 is considered. It is postulated that this phenomenon is associated with the influence of the general magnetic field of the sun on cosmic rays. Bibliography of 78 items. [63]

#### EFFECT OF CORPUSCULAR ACTIVITY ON ATMOSPHERIC ENERGETICS

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.505

[Abstract of article by G. Ye. Poloskin; Leningrad, TRUDY GLAVNOY GEOFIZICHESKOY OBSERVATORII, No 355, 1975, pp 85-93, "Effect of Corpuscular Activity on Atmospheric Energetics"]

[Abstract] A cross-correlation analysis was made of continuous series of the index of geomagnetic activity  $A_p$  and the kinetic energy of the atmosphere at different latitudes at the pressure altitudes  $H_{500}$  in the northern hemisphere during the period from August 1970 through April 1972. It was found that variations of the  $A_p$  index characterizing solar corpuscular activity are manifested at all latitudes and that the standard deviation caused by solar activity is 10-20% of the mean. Bibliography of eight items. [63]

#### PREDICTING 80-YEAR CYCLE IN CLIMATIC AND SOLAR ACTIVITY INDICES

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.506

[Abstract of article by T. M. Zushinskaya; Leningrad, TRUDY GLAVNOY GEOFIZICHESKOY OBSERVATORII, No 355, 1975, pp 104-112, "Manifestation and Prediction of the 80-Year Cycle in the Indices of Climate and Solar Activity. Part I, Climatic Indices"]

[Text] An 80-year cycle was detected in the growth of trees in the basin of the Colorado River during the period from 1744 through 1943 by a method proposed by the author. The 80-year cycle had phases of the maximum related to the following numbers of the 11-year cycles of solar activity: 0, 8, 15. The next phase of its maximum is expected in the 11-year cycle No 23. The conclusion is drawn that spot formation on the sun is responsible for the 80-year cycle. It is shown that the maximum of the last 80-year cycle in the growth of trees (11-year cycle No 15) corresponds to a break in the curve of temperature anomalies in the northern hemisphere and the maxima

of the two preceding 80-year cycles in tree growth (11-year cycles Nos 0, 1 and 8, 9) correspond to turning points in the course of some characteristics of three very long series of meteorological elements. The article includes a prognosis (11-year cycle No 23) and epignosis (11-year cycles Nos 0 and 8) of the phases of the maximum of the 80-year cycle in the frequency of spot formation, gives a climatic forecast -- the end of cooling, predicted by A. D. Gedeonov, and the beginning of warming in the extra-tropical part of the northern hemisphere in 11-year cycle No 23. Bibliography of 31 items.

[63]

#### MORE ON 80-YEAR CYCLE IN CLIMATIC AND SOLAR ACTIVITY INDICES

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.507

[Abstract of article by T. M. Zushinskaya; Leningrad, TRUDY GLAVNOY GEOFIZICHESKOY OBSERVATORII, No 355, 1975, pp 113-127, "Manifestation and Prediction of 80-Year Cycle in the Indices of Climate and Solar Activity. Part II. Solar Activity Indices"]

[Text] It is shown that during the period since 1744, into which three 80-year cycles of Wolf numbers fit, there was a systematic shift in the phases of the maximum of the 80-year cycle of the indices of climate and the 80-year cycle of Wolf numbers. The conclusion is drawn that this shift was caused by the same phase shift of the maximum of the 80-year cycle in the frequency of spot formation responsible for the 80-year cycle in climatic indices and the 80-year cycle of Wolf numbers. The author proposes two independent methods for detecting the 80-year cycle in Wolf numbers making it possible, using a Shove series for the period since 1619, to obtain a sample of the extrema of four 80-year cycles of Wolf numbers. The dynamic analysis principle is applied to the resulting sample. This makes it possible to double the initial sample, this affording an opportunity to detect a series of peculiarities in the course of the 80-year cycle of Wolf numbers, and also to express a series of hypotheses and prognostic considerations. Bibliography of 29 items.

[63]

#### SCREENING EFFECTS IN OZONOSPHERE

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.508

[Abstract of article by R. S. Steblova; Leningrad, TRUDY GLAVNOY GEOFIZICHESKOY OBSERVATORII, No 355, 1975, pp 23-41, "Screening Effects in the Thermal Regime of the Ozonosphere"]

[Text] The absorption of direct solar radiation by ozone can be regarded as the principal source of influx of radiant energy into the atmosphere below 70 km; this is confirmed by estimates of the relative contribution of absorbing components to the total quantity of absorbed radiant energy. The radiation arriving at a particular level is the residue of the energy not absorbed by the above-lying atmosphere. Taking into account the screening characteristics of the above-lying atmosphere, the author made computations of the quantity of energy absorbed by ozone during the daytime at altitudes 28, 24, 20, 16 and 12 km. The resulting values correlate well with the atmospheric temperatures measured at these same altitudes with ozonsondes. The peculiarities of the screening effect explain the presence of a low and even frequently negative correlation between ozone density and temperature, as has been noted by many researchers. Bibliography of 19 items.

[63]

#### SATELLITE OBSERVATIONS OF GAMMA RADIATION

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.659

[Abstract of article by A. I. Belyayevskiy, V. L. Bokov, V. K. Bocharkin, I. F. Bugakov, Yu. G. Derevitskiy, B. A. Dmitriyev, G. M. Gorodinskiy, Ye. M. Kruglov, Ye. V. Myakinin, G. A. Pyatigorskiy and Ye. I. Chuykin; --, IZV. KRYM. ASTROFIZ. OBSERV., 54, 1976, pp 343-346]

[Text] The paper presents the results of observation of cosmic  $\gamma$ -radiation using a  $\gamma$ -telescope with acoustic spark chambers from aboard the artificial earth satellite "Kosmos-561." The intensity of the flux of  $\gamma$ -radiation from the galactic center is  $E_{\gamma}$  ( $E_{\gamma} \geq 100$  MeV) =  $(8.3 \pm 2.7) \cdot 10^{-5}$  quanta/(cm<sup>2</sup>·sec). Comparison of this result with the flux measured on the SAS 2 leads to a satisfactory agreement. It is noted that a more precise and detailed picture of the distribution of primary  $\gamma$ -radiation will be obtained after processing information from the spark chambers. In addition, there are indications of registry of bursts of  $\gamma$ -radiation. Assuming as the mean number of quanta registered during the burst,  $n_{\gamma} = 4$ , the author obtained the number of  $\gamma$ -quanta per unit area during the burst  $\sim 0.1$  quantum/cm<sup>2</sup>. If it is assumed that the source of the bursts is localized in the Crab nebula, the upper energy limit for the burst at the source is  $\sim 5 \cdot 10^{39}$  erg.

[63]

#### OBSERVATION OF GAMMA RADIATION FROM "KOSMOS-555"

Moscow REFERATIVNYY ZHURNAL, ASTRONOMIYA, 51. OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.658

[Abstract of article by S. A. Volobuyev, L. V. Kurnosova, V. I. Luchkov, L. A. Razorenov, V. I. Ryabenkov and M. I. Fradkin; --, IZV. KRYM. ASTRO-FIZ. OBSERV., 54, 1976, pp 347-349, "Observation of Gamma Radiation on the 'Kosmos-555' Artificial Earth Satellite"]

[Text] The paper gives the preliminary results of an experiment for measuring primary  $\gamma$ -radiation aboard the "Kosmos-555" artificial earth satellite. A number of interesting astrophysical objects fell into the field of view of the  $\gamma$ -detector during the observations. These included Lib  $\gamma$ -1 and a  $\gamma$ -source discovered earlier on the "Kosmos-264" satellite. Attempts were made to discriminate the radiation from these objects. However, it was not possible to detect the flux of  $\gamma$ -radiation from them. The limits of the fluxes for these sources were found at the 95% significance level. For Lib  $\gamma$ -1 ( $E_\gamma > 100$  MeV) the flux was  $< 3 \cdot 10^{-4}$  quantum/(cm<sup>2</sup>·sec), for the source observed from "Kosmos-264" ( $E_\gamma > 100$  MeV) the flux was  $< 2 \cdot 10^{-4}$  quantum/(cm<sup>2</sup>·sec). Bibliography of seven items.

[63]

#### TWENTY-SEVEN DAY VARIATIONS IN COSMIC RAYS

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.428

[Abstract of article by V. P. Okhlopkov, G. A. Bazilevskaya and T. N. Charakhch'yan; Moscow, TRUDY FIZICHESKOGO INSTITUTA AN SSSR, 88, 1976, pp 94-113, "Investigation of 27-Day Variations in Cosmic Rays and Their Relationship to Nonuniformly Distributed Active Regions on the Sun"]

[Text] The authors made an analysis of 27-day variations of cosmic rays caused by the nonuniform distribution of active regions on the sun during the period 1957-1973. A study was made of the reasons for the unambiguous relationship between the amplitudes of 27-day variations in cosmic rays and the parameters of solar activity. Experimental data indicate that the spatial asymmetry of the solar wind occupies only part of the region of 11-year modulation of cosmic rays and its boundary moves from case to case. Bibliography of 35 items.

[63]

#### SOLAR WIND VARIATIONS IN SOLAR ACTIVITY CYCLE

Moscow REFERATIVNYY ZHURNAL, 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.51.430

[Abstract of article by V. A. Kovalenko and V. N. Malyshkin; Moscow, SOLNECHNYYE DANNYYE, No 9, 1975, pp 95-99, "Variations in Solar Wind Parameters During the Solar Activity Cycle"]

[Text] Observational data for 1962-1973 were used in a comparison of the changes in different parameters of solar activity with the parameters of the solar wind (velocity  $v$ , particle concentration  $n$ , density of kinetic energy  $E$  and fluctuations in the transverse component of the interplanetary magnetic field in the frequency region  $10^{-5}$ - $10^{-6}$  Hz). It is shown that during 1962-1968 the parameters  $v$ ,  $n$  and  $E$  correlated well with solar activity (the correlation was positive), but during 1969-1973 the correlation was violated and no relationship was discovered. Only magnetic field fluctuations in the low-frequency region change in the course of the cycle by almost an order of magnitude and duplicate well the course of solar activity. In the opinion of the authors, precisely this circumstance makes it possible to understand why there is a close correlation between the 11-year variations in the intensity of cosmic rays and geomagnetic activity with the 11-year cycle of solar activity (despite the fact that the corresponding correlation with the parameters of the solar wind  $v$ ,  $n$  and  $E$  is virtually absent). Bibliography of 16 items.

[63]

#### ATMOSPHERIC TRANSFER FUNCTION IN DIFFERENT SPECTRAL REGIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 9, 1976, pp 938-946

[Article by Ye. M. Kozlov and V. V. Badayev, Institute of Atmospheric Physics, "Aircraft Investigations of the Atmospheric Transfer Function in the Spectral Regions 0.61, 0.744 and  $1.036 \mu\text{m}$ "]

[Abstract] The paper cited above gives an analysis of the dependence of the atmospheric transfer function on the optical characteristics of the atmosphere and the underlying surface. The measurements were made from an IL-14 aircraft using a TF-11 telephotometer with a resolution of 0.005, 0.006 and  $0.015 \mu\text{m}$  in the spectral regions 0.612, 0.744 and  $1.036 \mu\text{m}$  respectively. The choice of these spectral regions was dictated both by the program of aircraft measurements and to a definite degree by the necessity for obtaining additional information for a more reliable interpretation of earlier results of measurements of the earth's brightness made from the "Kosmos-149" and "Kosmos-320" satellites which can be used in the problem of studying the earth's natural resources. On the basis of the computed data it was possible to derive a formula which can be used in conversion from the intensity of reflected solar radiation measured from a satellite or aircraft to surface brightnesses.

[70]



#### SENSING OF THERMAL-NON THERMAL RADIOEMISSION USING SATELLITE DATA

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 9, 1976, pp 947-952

[Article by L. G. Kachurin and V. I. Poltinnikov, Leningrad Hydrometeorological Institute, "Selection of Thermal and Nonthermal Radioemission in Sensing of the Earth from Satellites"]

[Abstract] A study was made of the relationship between thermal and non-thermal emission in different parts of the radio range applicable to the problems of their mutual discrimination for the purpose of determining both the radiobrightness temperature of the thermal emission and the characteristics of thunderstorm activity. The following types of non-thermal radioemission are considered: 1) emission from bolt lightning; 2) pre-thunderstorm emission; 3) continuous noise emission; 4) sporadic narrow-band emission. It was found that the effective brightness temperature of different types of nonthermal radioemission of clouds caused by their electric activity in a broad frequency range should be commensurable with the temperature of the thermal emission, whereas in the long-wave sector should considerably exceed it. In interpreting the results of satellite measurements in the radio range it is necessary to take into account the influence of thunderstorm activity of clouds in both the thunderstorm and pre-thunderstorm stages. Attention must also be given to sporadically arising narrow-band emission: in the case of coincidence between its frequency and that used in the spectral apparatus aboard the satellite it can completely distort the results of radiothermal measurements. Comparison of the nonthermal emission of clouds and thermal emission of the atmosphere yields useful information. The rather sharp difference in the amplitude-frequency spectra of impulses of these completely different emissions makes it possible to hope that if a satellite or orbital station carries receiving apparatus for the amplitude-frequency selection of "thermal" and "nonthermal" impulses new possibilities will be afforded for investigating the earth's atmosphere.

[70]

#### THERMAL FOCUSING OF RADIO WAVES IN IONOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 613-619

[Article by A. V. Gurevich, G. M. Milikh and I. S. Shlyuger, Physics Institute USSR Academy of Sciences and State Scientific Research Radio Institute, "Nonlinear Thermal Focusing of Radio Waves in the Lower Ionosphere"]

[Abstract] A study was made of the nonlinear focusing of radio waves caused by a change in the frequency of electron collisions in the lower ionosphere under the influence of a powerful wave. The article presents the

results of an experimental investigation [described in detail] of the effect of a powerful impulse on a continuous low-frequency radio wave. It is shown that the effect of thermal cross-focusing (any disturbance caused in the ionosphere also acts on all other waves propagating in the disturbed region) can be observed experimentally.

[73]

#### INTERPLANETARY MEDIUM AND COSMIC RAY ANISOTROPY

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 577-586

[Article by S. N. Vernov, B. A. Tverskoy, P. V. Vakulov, Ye. V. Gorchakov, Yu. I. Logachev and G. P. Lyubimov, Nuclear Physics Institute, Moscow State University, "Characteristics of the Interplanetary Medium and Anisotropy of Solar Cosmic Rays"]

[Abstract] In September 1973 the "Mars-4," "Mars-5" and "Mars-7" stations registered a new phenomenon -- an increase in the intensity of solar cosmic rays with negative anisotropy. The uniqueness of the observed phenomenon owed its origin to the relative arrangement of the measurement points and the coordinates of the solar flares; the measurement points and the solar flares were situated on different sides of the plane of the solar equator. On the basis of the newly acquired data, as well as information collected from space probes during the years 1965-1973, the authors propose a model of the propagation of solar cosmic rays in which the decisive role is played by screening of the fluxes of solar cosmic rays by regions situated in the solar equatorial plane and the existence of a region of reflection of solar cosmic rays at distances of about 2 a.u. In this model the solar cosmic rays injected by the flare arrive at the measurement point by two paths. One flux moves from the sun along the magnetic lines of force first to the south of the equatorial plane, then beyond the earth's orbit changes direction and returns to the sun to the north of the equatorial plane. The other flux first arrives from the southern hemisphere at the conjugate point in the northern hemisphere along the magnetic lines of force of the near zone or diffuses in the solar corona, after which it moves from the sun over the equatorial plane. The course of anisotropy at the observation point will be caused by the superposing of fluxes of solar cosmic rays arriving at different times in different ways.

[73]

#### MODEL OF DIURNAL VARIATIONS OF ELECTRON CONCENTRATION

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 642-646

[Article by B. A. Mirtov and A. G. Starkova, Institute of Applied Geophysics, "Model of Diurnal Variations of Electron Concentration at Altitudes 100-200 km in the Middle Latitudes"]

[Abstract] On the basis of the proposed method the authors determine the diurnal variation of the parameters of the upper atmosphere on the basis of data obtained using rockets and have formulated a middle-latitude model of diurnal changes in electron concentration in the altitude region 100-200 km. The relatively great quantity of experimental data used made it possible in some cases to give an analytical expression for the diurnal variations in electron concentration and give the standard deviations for the corresponding approximations. Table 1 gives the model for the electron concentration in the middle latitudes during the daytime under conditions of medium and high solar activity (eight fixed altitudes are tabulated). Table 2 is a corresponding model for nighttime in the middle latitudes for conditions of medium solar activity only.

[73]

#### TRANSIENT PROCESSES IN IONOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 647-652

[Article by L. S. Al'perovich and A. Ye. Levitin, Institute of Physics of the Earth and Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Transient Processes in Ionosphere and Their Possible Relationship to Geomagnetic Disturbances"]

[Abstract] Electrodynamic processes in the earth's ionosphere are naturally related to changes in both the electric field or conductivity and the pressure gradient. Study of the parameters of transient processes can shed light on the complex spectral pattern of geomagnetic variations, especially during substorms and storms. Such a study leads in the last analysis to formulation of an important geomagnetic problem: determination of the electrodynamic parameters of ionospheric plasma through a frequency-amplitude analysis of ground records of geomagnetic field disturbances. Accordingly, the authors have investigated the role of ionospheric transient electrodynamic processes in formation of geomagnetic disturbances. It is shown that involvement of the pressure gradient, electric field or conductivity leads to transient oscillatory regimes. The authors also review the principal peculiarities of transient regimes in the geomagnetic field. The materials presented here make possible a qualitative representation of magnetic response of the ionosphere to change in the electric field, pressure gradient or conductivity which occur during substorms.

[73]

## ION FORMATION IN HIGH-LATITUDE IONOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 674-678

[Article by N. V. Isayev and N. K. Osipov, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Ion Formation in the High-Latitude Ionosphere Due to Auroral Electrons and Short-Wave Solar Radiation"]

[Abstract] The principal regularities in the spatial structure of the ionization function in the high-latitude are considered. The effects of ion formation by auroral electrons and solar short-wave radiation are taken into account. The article gives the results of computations in the form of the ratio of the rate of ion formation due to short-wave solar radiation to the rate of ion formation by auroral electrons at local midday during the course of the year at the altitudes of the F region and E region for the auroral zone and for the region of the polar cusp and polar cap. The subauroral ionosphere during the daytime behaves like the middle-latitude ionosphere, that is, the ion formation function is determined by the behavior of the Chapman function. Only in the winter months does the corpuscular source exert an appreciable influence on the ion formation rate. At nighttime in all the defined injection regions, as might be expected, there is complete dominance of the corpuscular source of ionization except for the polar cusp and polar cap regions during the period of the summer solstice when the rate of photoionization is comparable with and can even somewhat exceed the rate of ionization by corpuscular streams. [73]

## CONTENT OF ATOMIC NITROGEN IN UPPER ATMOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 4, 1976, pp 702-705

[Article by V. N. Balabanova, K. D. Bychkova, V. N. Lebedinets and A. A. Pokhunkov, Institute of Experimental Meteorology and Institute of Applied Geophysics, "Temporal Variations in Upper Atmosphere Atomic N Content"]

[Abstract] For evaluating the amplitude of brief variations in the degree of nitrogen dissociation in the lower thermosphere the authors compiled Table 1, a summary of experimental values of the ratio  $[N]/[N_2]$  at altitudes 120, 140 and 150 km obtained in the USSR from rocket measurements using MKh-6407P radio-frequency mass spectrometers. The table gives the intensity of solar radio emission at 10.7 cm characterizing the solar activity level on the measurement day. Also given are three-hour values of the  $K_p$  index, diurnal sum  $K_p$  and amplitude  $A_p$ . The table shows, for example, that the  $[N]/[N_2]$  value can vary by more than an order of magnitude in less than a day. Table 2 is a summary of experimental  $[N]/[N_2]$  values at 140 km obtained in the middle latitudes using rocket mass spectrometer measurements and artificial ethylene luminescent clouds over a

long period of time -- 1962-1973. The indices of solar and geomagnetic activity given in the table show that the measurements relate for the most part to undisturbed or slightly disturbed conditions. In Fig. 1 the changes in the measured degree of nitrogen dissociation during the 11-year cycle of solar activity are compared with the change in the relative sunspot numbers W. Table 2 and Figure 1 show an obvious dependence of the degree of nitrogen dissociation at 140 km on the solar activity phase: during the solar activity minimum it can be less than 1%, whereas during the maximum it is 15-20%, that is, it changes by more than an order of magnitude. Superposed on these regular changes are irregular changes in the form of "noise" with a very short characteristic time of about several hours or a day.  
[73]

#### MAGNETOPAUSE POSITION AND GEOMAGNETIC PULSATIONS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI No 5, 1976, pp 895-901

[Article by P. A. Vinogradov, G. I. Zastenker, V. A. Parkhomov and M. Z. Khokhlov, Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Position of the Magnetopause and the Period of Geomagnetic Pulsations"]

[Abstract] This is an analysis of the dependence of the period T of geomagnetic pulsations on the extent R of the daytime magnetosphere; past efforts to establish a quantitative relationship between T and R have given contradictory results. Accordingly, the problem was investigated using the results of measurements of the position of the magnetopause on the "Prognoz" and "Prognoz-2" satellites and jumps of the magnetopause during sudden commencements of magnetic storms. On the basis of these data it was found that the dependence T(R) is slight and can be used only for an approximate estimate of the boundary of the daytime magnetosphere. During sudden commencements of magnetic storms a change in the period is discovered only in events when SSC is accompanied by pulsations of the Pc3R type. Part of the Pc3 spectrum is formed beyond the limits of the magnetosphere: the sources of Pc3 can be hydromagnetic waves generated in front of the shock wave front and waves which reach the earth with high-velocity solar wind fluxes.  
[83]

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